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TEETH for the CLAYTON ACT

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Editor

$5,000 fine and a year in jail if you give or knowingly get illegal price discrimination, says Patman-Robinson Amendment

IF you knowingly accept or induce illegal price discrimination you are as likely to draw a $5,000 fine and a year in jail as is the man that gave it to you. This is only one of the sharp teeth provided for the Clayton Anti-Trust Act of 1914 by the Patman-Robinson "Chain Store" bill passed by the late, unlamented Congress. Aimed at the chain stores and advocated by groups of independent storekeepers, it will go far beyond its original objective and disturb trade practices in every industry, and is likely to have far reaching effects on the metal-working industry. There is every probability that it will hit more innocent bystanders than culprits.

Industry was slow to realize the implications of this piece of legislation and did not organize effectively to resist its passage. Congress gave it but the scantiest study and passed it without having the vaguest idea of what it might mean. As a matter of fact nobody knows now how the courts will interpret the act, nor how much of it they will find to be constitutional. At the moment, therefore, we can only get out the red flag once more, although it is almost worn out, and wave it vigorously to warn readers of *American Machinist* that here is another New Deal law that bids fair to cause them a lot of trouble.

In order to keep this article within reasonable bounds resort will be had to summaries. The Patman-Robinson Act amends Section 2 of the Clayton Act. The major changes, as listed by the National Association of Manufacturers are given on the next page.

Every trade association and information service that has studied the Patman-Robinson Act is urging the manufacturer and the distributor to go over their pricing policies and price lists with their legal advisers to make sure that these are still legal. It seems sound.

Administration of the Act lies in the hands of the Federal Trade Commission. Under the terms of the Act the accused is considered guilty until he clears himself, a radical departure from traditional principles of civil justice.

What may be some of the specific applications in our own field? Let us suppose that we are selling a machine tool or some other piece of manufacturing machinery, with which goes a good many dollars' worth of engineering service, usually not paid for—by the big customer, anyway. Suppose fur-

Some Clayton Act Changes Made By the Patman-Robinson Amendment

1. The Clayton Act prohibited price discriminations only when the effect of such discrimination was substantially to lessen competition or to tend to create a monopoly in any line of commerce. The Patman-Robinson Bill has extended the prohibition to include any discrimination which may injure, destroy or prevent competition with the parties to the discrimination, or with their customers, without any necessary effect on the general level of competition in the industry or trade generally, or in any particular locality.

2. The Clayton Act expressly allowed a discrimination in price based on differences in the grade, quality or quantity of the commodity purchased. The new Act allows price differentials base on quantity only to the extent they reflect differences in the cost of manufacture, sale or delivery resulting from the "differing methods or quantities" in which such commodities are sold.

3. The Act allowed a discrimination in price in the same or different communities made in good faith to meet competition. The amended Act does not authorize such price discriminations expressly, but does permit persons charged with violating the law to prove in defense that a discriminatory price was made in good faith to meet the lower price of a competitor.

4. The Clayton Act contained no prohibition against discrimination in the type of services performed by the seller for different buyers, or with respect to different allowances made by the seller for services or facilities furnished by the purchaser. The new Act requires the seller to treat all customers on proportionally equal terms.

5. The Clayton Act contained no prohibition against the granting of commissions, brokerage or other allowances to persons acting for or on behalf of the purchaser. The amendments prohibit such payment or allowances, except to persons performing services for the seller.

6. The Clayton Act contained no criminal penalty for a violation of Section 2 relating to price discriminations. For specified violations, the amendments impose penalties of fine and imprisonment.

7. The Clayton Act imposed upon the Federal Trade Commission the burden of proving that any alleged price discrimination came within the general prohibition of the law, and not within any of the exemptions specifically provided. The new Act purports to create a presumption that any price discrimination is unlawful, and places upon the person accused the duty of proving the contrary before the Commission.

8. The prohibitions in the Clayton Act applied only to persons granting the price discrimination. The new Act would make is equally unlawful for any person knowingly to receive the benefit of any discrimination now declared unlawful.

ther that we give such engineering service to one customer and not to another, or that one customer needs twice as much of it as another one does, and gets it. Wouldn't this be a price discrimination under the terms of the act? It looks so. And both the seller who gave the service and the buyer who demanded it would be in danger of fine and imprisonment.

Or let's say we are dealers buying electrical equipment for machines for which we are agents. If we don't get the same discounts that are given to the manufacturers, where the equipment is installed at the factory, can we claim discrimination against the electrical supplier? It would seem so.

The Machinery and Allied Products Institute raises this question: What is the legal effect under the terms of the Act of acceptance of used products as part payment for new products, under certain conditions?

Here's another one. Would it be illegal under the new law for an automobile manufacturer to use the local stock of a twist drill or grinding wheel manufacturer as his stock room, calling for small deliveries every day or so as need arose, and demanding the same prices and discounts as the buyer who got his yearly supply at one time and stored it himself?

Here we find that price discriminations are allowable, under the law, if the methods by which the commodity is sold or delivered to various customers are different; or if the quantities differ. A quantity differential, however, is limited to the actual difference in cost resulting from manufacturing selling or delivering a larger amount of it.

Nelson B. Gaskill, former member of the Federal Trade Commission, in an analysis of the Act published by the Kiplinger Washington agency, points out in this connection that it provides specifically for certain legal varieties of price discrimination. These are included in paragraphs 2 and 3 of the N.A.M. summary. Any other kinds of price discrimination are declared to be illegal.

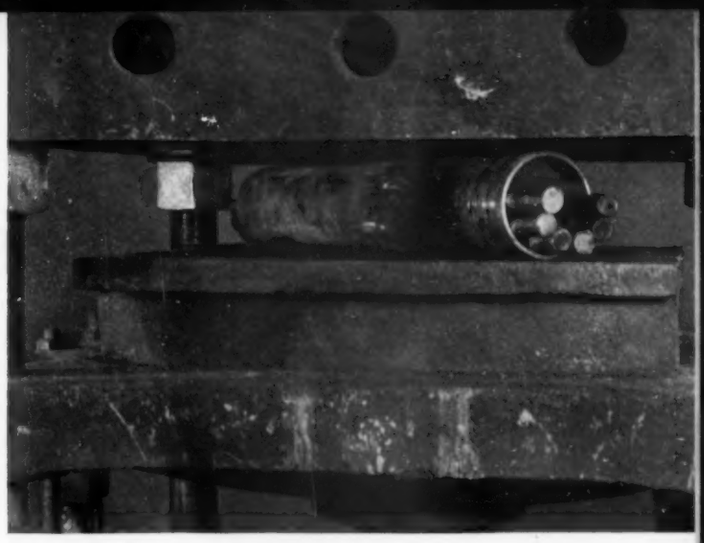
He goes on to say, "This law makes no provision for the justification of the trade discount and therefore prohibits its use. This is wholly different from a quantity discount. The trade discount was contained in the original draft but was eliminated in the conference report without explanation or comment. If judicial research goes back so far, the only conclusion as to the legislative intent which the courts can reach is that Congress intended to exclude the trade discount and to substitute what I have called the cost-quantity discount.

End of Distributors Seen

"The classification of customers for the purposes of price or discount differentials disappears. Customers may be classified by service function only for the purpose of customer selection. Failing such selection and refusal to sell, the manufacturer must justify all price differences as between purchasers under the provisions of this law. The law points the way to the economic extinction of both the wholesaler and the retailer."

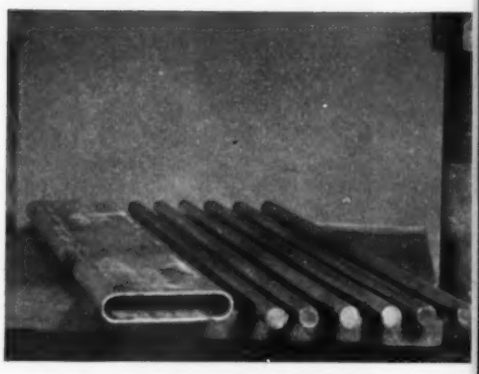
Looking to the future, Mr. Gaskill thinks, "There will follow from this law a revolutionary decentralization and relocation of industry. Mass production in highly specialized centers will give way to series of small factories. Mass distribution will disappear with mass production. Labor and population congestion will break up in the diffusion of industry. Property values, mortgage and other securities will be revalued. Rents and tax ratables will be reduced. Prices will become factory prices and the goods produced will accumulate transportation charges as they move outward until it becomes cheaper to produce them somewhere else. Thus regional production and distribution areas will be created and industry will be relocated within these areas, taking the working and service population with it."

FLATTENING TUBES in a PRESS



FIRST *Tube with rods in place before pressure is applied*

SECOND *Flattened tube before rods have been removed*



THIRD *Finished tube, rods removed*

TO avoid the difficulty of sawing and burring of elliptical tubing a new method of flattening tubes of circular section has been worked out at the Pittsfield Works of the General Electric Co. The old method consisted of passing the tubes through rolls until the desired cross section was obtained. By the new method, which has been patented, a circular tube is packed with lubricated rods and flattened between the platens of a hydraulic or mechanical press. Cutting to length and burring are done before the flattening operation. Cylindrical tubes are relatively easy to cut off and burr.

Selection of the right number and size of rods to give the final section is vital to satisfactory results. Any good machine oil can be used as a lubricant.

The contours and areas of the cross sections of the rods, and the number required are calculated. Factors which must be used include: Periphery of the wall of the tube before and after being flattened; the area included within the walls of the tube; the relative dimensions of the point of contact of the inner wall with the rods, and the outer wall with the platens; and the tensile strength, ductility, hardness and other physical characteristics of the tube material.

As illustrated in the three progressive views of a simple flattening operation, the sequence of steps is: (1) Insert the rods in the tube and place the combination in the press; apply pressure to flatten the circular section of the tube until it has assumed the shape dictated by the rods; release pressure and withdraw rods. The rods can be used over and over. In some operations the rods are fastened together in groups.

While this process was invented to fabricate water heating tubes in a domestic oil furnace boiler, it may be applied to making radiator tubes for cooling oil in transformers, for making insulating tubes to be used between parts of transformers, and for similar purposes. It is covered by Patent No. 1,982,362.

MACHINES, TOO, NEED

They can run without paint, but good appearance actually aids production

• It takes skill to apply the first filler coat with a leather pad, but it's this operation that smoothes out irregularities in the casting

• With the work mounted on a truck for convenience in moving, two men hand brush the priming coats

AN unpainted machine tool would be unwelcome in any shop. Theoretically it should function as well as a highly finished piece of equipment. Perhaps it would be just as durable and withstand obsolescence as long as its nicely painted counterpart. But the fact remains that it would be an eyesore that would lower the tone of the entire plant.

Good looking machine tools have a definite sales appeal. They reflect the pride of the maker in a good product. But, even more important, they impart this pride to the men who operate them and thus actually contribute to a better product. A smoothly finished surface is easily cleaned, and cleanliness is contagious.

The automatic screw machines of the National Acme Company afford an example of finishing in this field. After the castings come from the foundry, they are inspected for flaws; any pronounced irregularities, such as caused by mold sections which do not match correctly, are ground smooth with air grinders fitted with carbide of silicon wheels of approximately 36 grit and medium hard grade. Painting magnifies these imperfections.

The first step in painting consists of giving the castings two coats of primer which is brushed on by hand. Usually two men work on one casting located on a truck for convenience in moving. As the castings for these machines are comparatively heavy, they are not always brought to the painting department. Generally they are painted adjacent to the production line.

After the priming coats are dry, two filler coats are applied. The object of the filler is to level inequalities and create a comparatively flat surface. The first filler coat is applied by hand with a leather pad, an exacting operation, for if it is not done properly the inequalities will show up when the paint is put on. The second coat is brushed on after the first has dried.

BEAUTY

FRED B. JACOBS

When thoroughly dry the casting presents a smooth surface when viewed from a distance, but close inspection would reveal many slight inequalities. The entire surface must be rubbed down by hand with No. 100 manufactured alumina paper. Dry rubbing has been found satisfactory and economical.

Inside portions of castings, such as the headstock, the spindle carrier housing and the upper frame member, are painted white. Two coats are applied by hand brushing. The object of the white paint is to aid the assembler's vision when he is working on the inside of the casting and to seal permanently any grit or sand on the surface that might find its way into the lubricating oil in which the running parts are flooded when the finished machine is operated.

After the outer surfaces have been rubbed down they are given a coat of sealer which is specially made for this purpose.

Numerous smaller parts are finished in the same manner in the painting department. Plenty of room and convenient work benches are provided to expedite the work. Parts proceed through this department in lots of six, ten, or more. In working on a certain part, a painter will finish all like parts on that order.

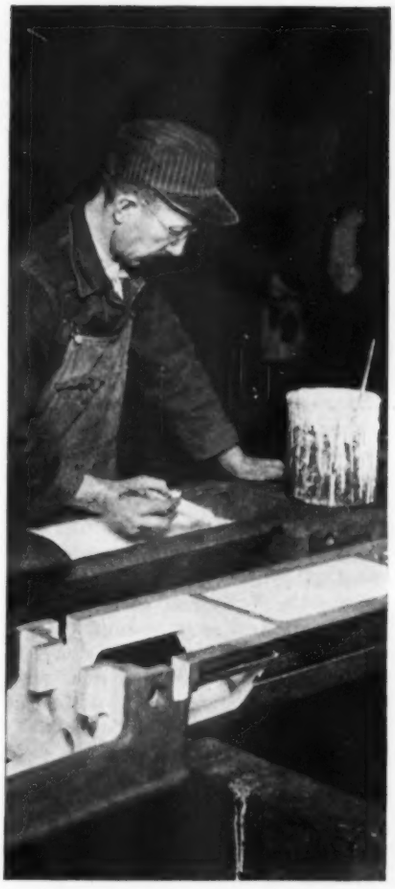
A large number of comparatively small parts are spray painted. For this operation parts are placed on a convenient turn-table in a booth provided with an air exhaust system to carry away fumes. The pressure gun handles primer and sealer coats, but the filler must be applied by hand as it is too heavy to be handled by the spray method.

During the assembly operation it is impossible to prevent the finish being marred to a certain extent. If the assemblers were ever on the watch not to mar the finish, production would be retarded. Thus reasonable care only is exercised. The rubbing of a chain hoist fall or slight blows caused by one painted part coming in contact with another will chip away the finish. After the machine is entirely assembled and tested, pronounced satisfactory and ready to ship, it must again go to the painter's hands for final finishing.

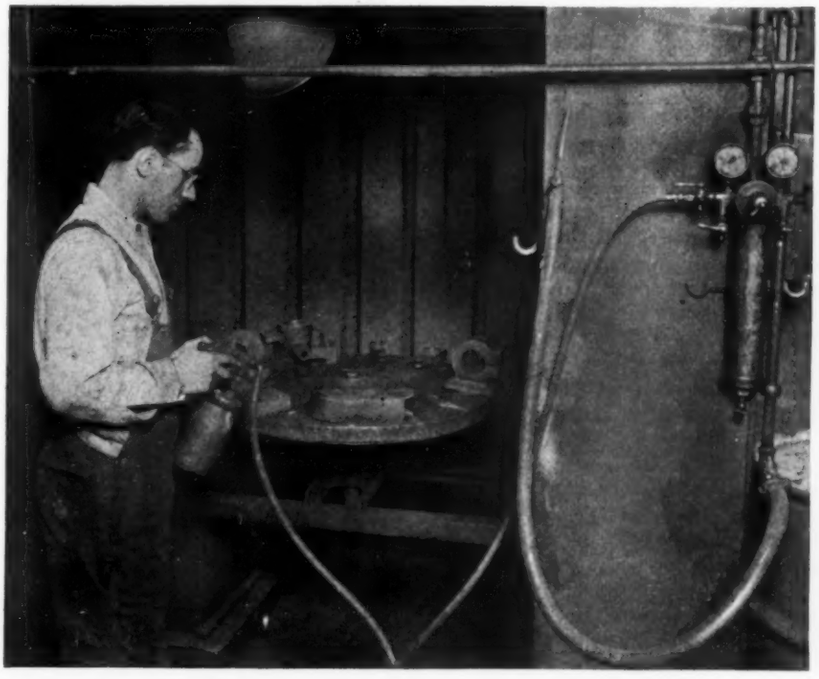
First the machine is carefully cleaned inside and out by a grease solvent applied with a spray gun. Then when the machine is thoroughly clean, the painters go over it carefully to inspect each painted surface. Places that have been chipped are again filled carefully. After the filler is dry it is rubbed down carefully with No. 100 manufactured alumina paper to present a smooth surface.

The next and final operation, done just before the machine is crated for shipment, is to paint the outside machine tool gray and the inside portions white. This is an exacting job, for the painters must cover the surfaces entirely and at the same time they must not daub finished steel surfaces.

Painting the inside portions white is difficult, of course, as the surfaces are partly hidden, but by means of strong flood lights to illuminate the interior of the machine and small brushes to get into confined places a satisfactory job is done.



• *Assemblers' vision is aided and grit is sealed into interior surfaces by coats of white paint hand applied*



• *Small parts are mounted on a turntable and spray painted in a booth provided with fume exhaust*

ALLOY WELD TECHNIQUE

Alloys are bad actors if the welder doesn't know how they react to heat and their thermal expansion

MILES C. SMITH

THOSE of us who are devoting our time and energy toward the further development of alloy-metal welding, recall our earlier attempts, and feel that the attainments are little short of miraculous. Further, we are confident that alloy welding has progressed sufficiently for us to formulate a few rules to guide the less experienced.

Take the welding of 11-14 per cent manganese steel as an example. Only a short time ago checks and cracks in the body of a manganese weld were countenanced as unavoidable. Just so long as the entire weld mass didn't fracture through or pop off, the weld was recognized as a successful one.

But we have no checks or cracks in our manganese welds of today. We pile the weld metal layer upon layer, inches high, or fill in a crack inches wide, and not a single minute crack or check can be found. We have learned how to weld manganese steel.

In principle, the welding of ferrous alloys is not so different from welding mild steel. In both, the welder forms a casting under adverse circumstances. He depends for success upon his own skill and the skill of the manufacturer of the welding rod or welding electrode. The chances are that the weld will be a good one if the deposited weld metal can be made to penetrate into or interalloy with the parent metal at what is known as the line of fusion without producing an overheated area in the parent metal adjacent to the weld; if the weld metal can be kept from oxidizing or changing its chemical composition and free of impurities so that it will form a solid body, and if it will cool off as suddenly as welds do yet retain its desirable physical properties. These results are a good deal to ask of any weld metal, and decidedly too much to expect of an alloy containing easily oxidized and chemically active components. That such a weld is being made speaks for itself.

One need go no further than stainless steel in a search for an illustration of chemically active constituents that have responded to and have been held in check by the welder's skill. This ever-bright metal, which has been given credit for stimulating ferrous-alloy welding development, acquires its corrosion-resisting properties through the chromium it contains. Chromium, as any metallurgist knows, is chemically active, easily oxidized and readily disappears from the alloy containing it when that alloy is subjected to relatively high heats.

The welding problem is approximately the same for any and all of the alloys in the stainless class. To "hold the chrome" is the cry most often heard in connection with stainless-steel welding, and it is a justifiable one. The chromium must be held if the weld is to be a success, but that is more a worry for the welding-rod or welding-electrode manufacturer than for the welder. If the necessary amount of chromium isn't in the rod or the electrode at the start, there is nothing the welder can do about it but get another source of supply. In so far as holding the percentage of chromium in the weld metal that is in the rod or electrode, the welder is up against it again. In oxyacetylene welding, a flux may be used that will assist in counteracting a chemical change, but in metallic arc welding the electrode manufacturer is compelled to shoulder the entire burden. The analysis of the electrode and the analysis-retaining flux coating must be right.

When a metallic arc-welding electrode isn't puddled there is a definite fusion boundary and an overheated section adjacent to it. Magnification, 100 X

Welding technique, on the other hand, is the welder's worry. No matter how good the welding rod or welding electrode may be, it is decidedly up to the welder to make a good weld and preserve the essential and desirable properties of the parent metal. Overheated areas, buckling, loss of chemical and physical properties, are seldom thought of in connection with mild-steel welding. The industry has progressed beyond that list of old bugaboos, but when the welding of ferrous alloy metals is attempted the old-time handicaps bounce back with a vengeance.

Naturally, welders are not expected to be metallurgists. But it is important that any welder school himself in the more important characteristics of the alloying elements before attempting to weld the less frequently used ferrous alloys. It is necessary that chromium, silicon, manganese, nickel, titanium, telurium, berylium, molybdenum, tungsten, and other alloying elements be more than mere names. The welder need not have the complete chemical and physical description of each element at the tip of his tongue, but he must have a fairly good conception of the purpose of each alloying element and some idea of how each

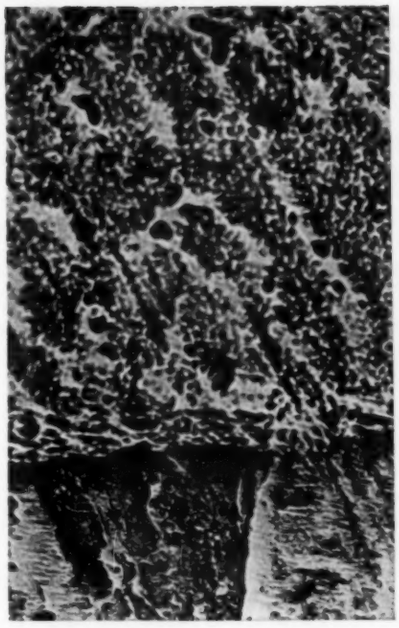
type of alloy reacts to heat and cold. Such information is:

Carbon steels containing chromium have a tendency toward abnormal grain-growth when subjected to heat. Carbides form adjacent to the weld and unless such alloys are normalized after the welding operation the over-heated areas become brittle and lose their desirable physical properties. Chromium is a very active element and it is only by the addition of nickel or some similar and more stable alloying element that chromium alloys become suitable for successful welding. Chrome-nickel, chrome-vanadium and such alloys can readily be welded, and, if the proper weld metal and the proper welding method be employed, the chemical analysis and the physical properties of both the weld and the parent metal can be retained. Even then, normalizing after the welding is desirable and recommended.

Welding heats are high. Further, the heat is localized during the welding operation. Parent metals that have a high rate of thermal expansion, as many of the ferrous alloys do have, are subjected to locked-up stresses when they are welded. These stresses can do little else than sponsor physical failure. Oxyacetylene welding can be made to take care of normalizing to some extent. Since the modern tendency in ferrous-alloy welding is toward the adoption of the metallic-arc method, the only sure way to relieve the locked-up stresses is to heat the assembly and quench or not as warranted.

Welding technique of the oxyacetylene process, when ferrous alloys are being welded, resolves itself into the use of a small absolutely neutral, or very slightly carbonizing, flame and utmost care to insure against "burning" the parent metal. A completed smooth weld should be formed at the first pass. Reheating, other than to normalize the assembly, must be avoided. Fluxes are essential when chromium or any other chemically active and easily oxidized element is to be retained in both the parent metal and the weld.

In metallic arc welding, the welder usually meets his first stumbling block in selection of an electrode. *Use a small electrode* and puddle it in. The electrode must be fluxed to generate a gas mantle about the weld and to deposit a slag covering over the weld. No one can hope to prevent oxidation of easily oxidized elements unless every step be taken to keep the oxygen of the atmosphere from the weld area while the metal is molten. Then, *use the proper amperage,* or heat, and a short arc. For chromium alloys, use



With a correctly done weld there is perfect interalloying of the loose-grained weld deposit and the close-grained rolled metal. Magnification, 1000 X

only sufficient amperage to form the weld. In other words, run the electrode as cold as possible, for chromium alloys are very sensitive to heat. Take 18 per cent chromuim, 8 per cent nickel and relatively low-carbon steel for example. The thermal expansion of this alloy is 60 per cent more than that of common steel and the heat conductivity only one-third that of common steel. The consequence is that the welding heat is confined to a much smaller area than in common steel welding and overheating is produced.

Copper-bearing steels, or other alloy steels which have a high rate of thermal conductivity and lower coefficient of expansion, act quite differently from the chromium alloys. They may be welded much faster and with considerably more heat because the heat is conducted away from and not confined at the weld. *There is a proper heat for each type of electrode* and the welder who wishes to succeed must determine it and retain it, although it may be slightly different each time the same parent metal is welded. Thickness of section, atmospheric conditions and other local factors must always be taken into consideration and are responsible for the deviations.

Manganese steel is another example of a parent metal that will withstand welding with relatively high amperages. There was a time when manganese steel was welded cold. That was the checking and cracking era. Today we have introduced a rather small proportion of nickel into the manganese steel electrodes and we run them on hot. A flux-generated gas mantle keeps the molten metal free of oxygen and nitrogen and the nickel-alloyed mass cools under its slag covering to a solid mass that is free of checks and cracks.

No Tungsten in Rod

Tungsten-bearing alloys, such as tools are made of, are not difficult to weld when the proper electrode and welding method are used. It is not necessary to have more tungsten in the weld than can be picked up from the parent metal while the welding operation is in progress. Use an electrode containing, along with iron, carbon, silicon and manganese, chromium and vanadium, but no tungsten. This will give a satisfactory weld in tungsten-bearing high-speed steel for both strength and renewal. Furthermore, chemical analysis of such welds shows that tungsten actually does leave the parent metal to flow through and interalloy with the elements originally in the welding electrode as the weld forms. By using a rather small electrode, welding from both sides when thickness of section is ¼-in. or more, and V-ing the metal to facilitate easy puddling, complete interalloying of the parent metal and the weld metal is assured.

The drawing of elements from the parent metal into the weld metal, during the formation of a weld, brings up another phase of ferrous alloy welding; namely, the advisability of using welding rods and welding electrodes which have an analysis unlike that of the parent metal.

Prior to the time when alloy welding rods and electrodes of various analyses were available, the only thing to do was to cup strips from the parent metal to be welded, prepare them as best one could and utilize them for the welding. But such a procedure is no longer necessary or advisable. Today, welding rods and electrodes of practically every commercial alloy analysis are available. The welder needs only to make a careful selection to obtain the results desired. These results need not necessarily be a weld mass with the same constituents in identically the same proportions as the parent metal.

If a weld is to become an integral part of an assembly in which the chemical and physical properties of the parent metal are essential for success, as in the case of stainless, or corrosion-resisting, steel, the weld formed must have identically the same chemical analysis and identically the same phy-

sical properties as the parent metal. If, on the other hand, physical properties only, or chemical properties only, or properties unlike that of the parent metal are required or may be tolerated, the electrodes or the welding rods can be quite different in composition from the parent metal just so long as the weld formed will alloy with the parent metal when both are fluid. In fact, it is quite often desirable to use welding rods and electrodes of contrasting analysis to obtain the best results.

For example, it is often necessary to weld ferrous alloy for strength only. That is, the weld formed must be as strong as, or even stronger than, the parent metal so that the assembly will resist fracture at the weld.

High-Strength Rods

Castings are rarely as strong as, nor do they resist fracture as well as, forgings or rolled metals, and a weld at its best is a loose-grained casting that has been formed by natural crystallization or solidification of fluid metal. The parent metal, however, may have been worked, forged, and even heat-treated to bring out the best that was in it. In such cases, in order to obtain sufficient strength in the weld, it is necessary to select a welding rod or electrode which will form a casting that has the physical strength in cast form that the parent metal has in worked or refined form. Such cases may occur in mild-steel welding, but, because ferrous alloys exhibit quite different physical properties under various conditions and in various states of crystallization and refinement, the selection of rod or electrode is all important in the welding of ferrous alloy metals.

Overlaying, that is, the welding on of a wear-resistant surface, is also possible with ferrous alloys and comes under the head of welding rods and electrodes with a composition unlike that of the parent metal. The deposit from any rod or electrode that will interalloy with the parent metal can be welded to a ferrous alloy's surface, but whether it performs successfully or not depends quite largely on how much cognizance was taken of the thermal expansion rate of both the parent metal and the overlay. If there is too great a difference in the rate of expansion and contraction of the two, the locked-up stresses resulting from welding, will either pop off the overlay or fracture the parent metal.

All in all, ferrous alloys are not so difficult to weld, if the welder will only take the characteristics of the metal into consideration and act accordingly. Success depends entirely upon how well each alloy's peculiarities are known and provided for.

Take the subject of V-ing the metal for a seam or butt weld. Alloys like the 18-8 chrome-nickel group and others of the stainless class, because of their slow rate of heat conductivity, permit of much deeper penetration than those alloys which have a high rate of thermal conductivity. Scarfing the edges of stainless steel is unnecessary unless it is 3/16-in. or more in thickness. When the sections run up to ¼-in. or more it is well to weld from both sides if possible. In fact, welding from both sides of any ferrous alloy that is more or less sensitive to the action of heat is advised and recommended.

Welders recall the care and preparation for mild steel welding some years back, and their recollections may serve as a guide when the more stubborn ferrous alloys are to be welded. Rapid, single-pass, large-electrode, high-heat and large-flame tactics just won't do. To weld a ferrous alloy successfully, the electrode must be small, the amperage right and careful puddling employed when the weld is made electrically. If the oxyacetylene torch is used, the flame should be as nearly neutral as possible and as small as necessary to fuse and not burn.

Maintenance Welding Aids

It may be well to mention a method or two that can be employed to guide the maintenance welder who has no easy way of telling exactly what the chemical constituents are of the work he is asked to weld. On new work, the analysis of the parent metal is known or may be ascertained, but in maintenance work an analysis would be difficult or impossible to obtain.

One suggestion is to test the metal and observe its action under heat Does it expand rapidly? Does it seem to conduct heat rapidly? Is it hard? Does it appear to be high in chromium? Does its use suggest that it may be a nickel or a vanadium alloy, either with or without chromium? If none of these tests give any useful light upon the subject, the one thing to do is to select a welding rod or electrode which will deposit a metal of the desired characteristics and which will alloy well with iron, then weld slowly and carefully. I have found that an electrode that has a medium carbon content, contains chromium and vanadium, and is very low in sulphur and phosphorus, makes a very good all-purpose electrode for welding unknown ferrous alloys. Its deposit, when pure, has inherent strength, density, and will respond to heat-treatment. With mild steel this electrode produces a weld of surprising tensile strength and any common alloy of steel or iron does not interfere with its functioning.

So far only those ferrous alloys which come under the classification of steels have been considered, because ferrous alloys in the iron class are rarely used and rarely welded, but they may be welded. Recently, a copper electrode with a mineral flux shield has been found particularly advantageous for the electric arc welding of various types of cast iron, malleable iron and other metals in the high-carbon range. Copper is a natural alloying element of iron. While copper does pick up and solidify the carbides, it makes a strong weld with a tensile strength considerably above that of cast iron or malleable iron. Another advantage of such an electrode is its low melting point, making possible the welding of such metals without preheating.

So, although the ferrous alloys may be successfully welded, they deserve and must have better treatment at the hands of the welder than mild steel. If they expand very rapidly under heat, the expansion must be heeded and compensated for. If they are slow to conduct heat away from the weld area, the welding heat must be kept low and every care taken to prevent the overheated area adjacent to the weld from becoming a section of "burned" metal. Unfortunately, space prohibits a minute detailing of each alloy and its peculiarities, or even each alloying element, but it is hoped that enough detail has been given to start the welder thinking along the proper lines and guide him so that he will not knowingly stumble into the largest of the pitfalls.

Even fairly accurate lead screws from the toolroom viewpoint may have some sections that are better than others. It is a good plan to test different parts of the screw and note where the most accurate spots are located. These can often be saved for use when a particularly fussy job comes along. Unless the screw to be cut is longer than usual, say over three or four diameters, there are spots on most lead screws that will give results that are satisfactorily accurate.

Group production is what makes profits rather than spectacular performances on individual parts. And group bonus can help this where it is properly handled.

Talking Shop

Industrial Relations

Up at Silver Bay last week the experts on industrial relations got together and had a grand time talking over the technicalities of their craft. Doubtless, a lot of good will come out of the discussions and comparing notes.

Next month a very select group, much smaller, will meet at Princeton University for a week's course of study in the same field. They will be limited to one or two from each big company and the lecturers who will address them will be headliners in their respective specialities.

These two gatherings exemplify Industrial Relations, in capital letters. They are important in these times. Let us hope they will be able to keep us out of the kind of class warfare that has so profoundly altered the map of Europe, and is now devastating Spain.

Large companies have been successful in handling their relations with their men through professionals. Small companies, fortunately for them, can do at least as good a job without professional help, provided the man at the top knows his way around. Such organizations are numerous in New England, and some of them are worth telling about.

P. O. Relations

Somebody asked the famous head of a northern New England machinery builder how he handled industrial relations. "In the post office, or the corner drug store," he replied. A few

words but they say a lot, when you stop to think of their implication. Such casual meetings are commonplace in a small community, where everybody knows everybody else, and the man with a grievance can get it off his chest when he happens to meet the boss up town, instead of making an issue of it by going to the head office. Somebody is always watching that office door and word gets around quickly that so-and-so was up to see the boss this morning. And then the rumors start. It's vital to have the door open for men with something on their chests, but a lot safer to have them get it off somewhere else.

Another company head asked us if we had noticed how many of the men in the shop called him by his first name as we walked through. We certainly had, and had made a mental note to congratulate him later. "Do you think it sounds undignified?" he asked. We did not think so, emphatically, and we said so. Who wouldn't rather have his men call him by his name to his face, instead of being "mistered" to his face and called something far less respectful behind his back?

There are such people, we admit, but they're not managers.

They Like to Fish

This president went on to remark that most of his organization likes to fish as much as he does. "This spring," he said, "the first fellow I met on my

favorite stream was my best boring mill hand. We were both playing hookey. What could I say to him?" We didn't know. "Well, all I could ask him was how many fish he had in his basket."

We submit that if you know your men that well you don't need to worry much about industrial relations.

Incidentally, this same man told us about getting a call at his home one evening from one of his men who thought he wasn't being treated right and had been trying to drown his feelings. If the fellow had come to the office in that condition there would have been nothing to do but fire him. As it was the president drove him home and put him to bed.

Tell that one to some of the labor unionists who think they are class-conscious.

Laughing Machinists

A friend of our in Sweden wants to put a question up to the trade. Here it is.

"Some time ago I heard a physician say that we all laugh too little. He claimed that when laughing we exercise our internal organs, which is very good for our health.

"It struck me that machinists, engaged as they are in serious work, should laugh more than they do. I don't mean they should imitate 'The laughing policeman' so they would annoy their fellow workmen, but I think every machinist should try to create a disciplined, laughing atmosphere around himself. This would promote a larger production and everybody should feel happier.

"I wonder what machinists think about this suggestion."

We wonder too. And we also wonder what would happen if some Swedish machinists we have known ever took this suggestion up seriously.

The Editors

SUBWAY BEARINGS Must

Bearing and axle maintenance on New York Rapid Transit Corp. system is vital factor in carrying half-a-billion persons a year

FRANK C. HUDSON

NOWHERE is bearing maintenance more important than in subway train passenger service. Here, where train headway is a question of seconds, a hot bearing is likely to tie up thousands of passengers, setting the stage for a disastrous panic.

For this reason the New York Rapid Transit Corp., known locally as Brooklyn-Manhattan Transit, pays particular attention to every phase of their bearing practice from the metal used in the case of babbitt to the methods of heating and machining all bearings. This care also extends to the axles where the most modern practice prevails.

Linings are of babbitt, cast into bronze bearings in a special department, a part of which is seen in Fig. 1. The metal used is carefully checked by analysis, modern furnaces are used for heating and molds are carefully prepared as can be noted on the bench in the foreground. There is quite a variety of bearings as can be seen. Some of these take the thrust at the end of the axle instead of by a collar as indicated by the solid end bearings near the buffing stand, and in Fig. 2. The ends are anchored in holes drilled in the bearing itself before the babbitt is poured.

Bearings are bored in a special fixture on a Warner & Swasey turret as in Fig. 2. The bearing is held in a fixture bolted to one face of the turret which aligns them with the lathe spindle that carries the boring bar. The boring bar is of large diameter and very stiff to avoid deflection. It carries a tool setting gage that is not only ingenious but saves a lot of time in changing from one size bore to another.

The collar shown is a good, sliding fit on the bar. It has numerous bushings at different distances from the center of the bar. Each bushing repre-

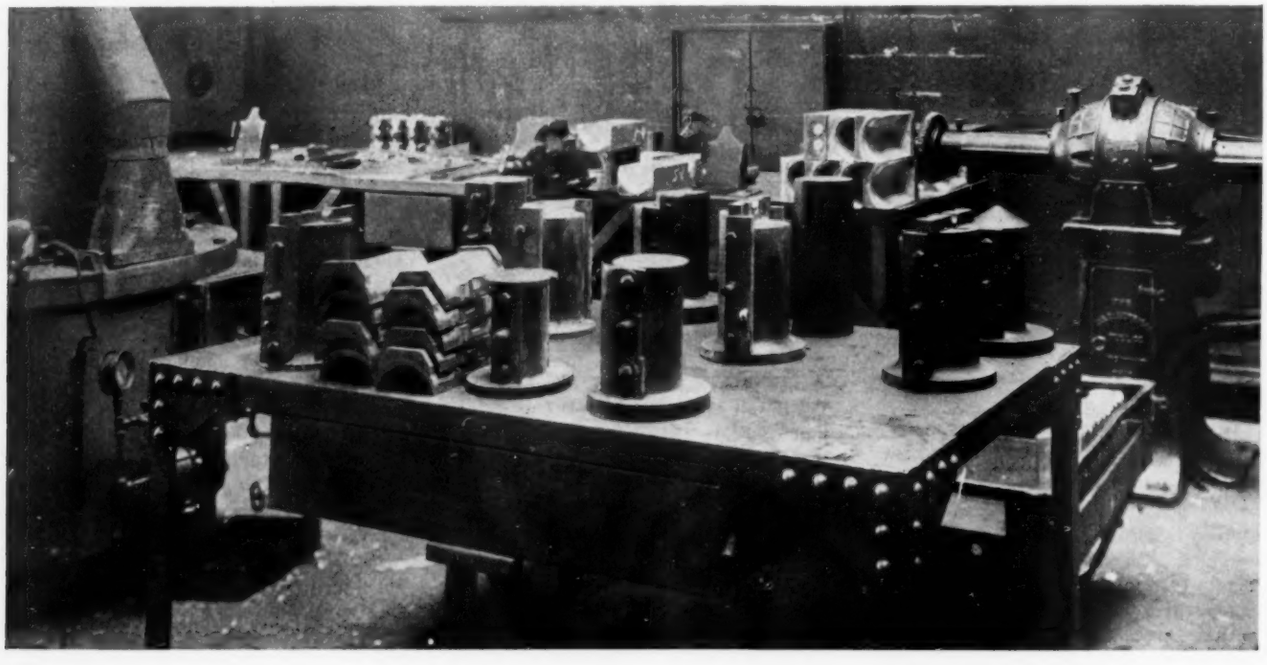


Fig. 1—Babbitt-lined bronze bearings are made in a variety of types under carefully controlled conditions

Be RIGHT

sents the diameter to which the bearing must be bored to fit a given axle, and each has its size plainly stamped on the collar. To set the cutting tool for a new size the pin shown is slipped into the proper bushing, the collar moved to bring the pin over the cutter, which is set to contact the pin. The collar is then moved back to the shoulder on the bar, out of the way of the work, and is not used again until it is necessary to reset the cutter, either for a new size or after sharpening. The method greatly simplifies the setting of the tool for any size within its range, saves much time in measuring and prevents mistakes by having each bushing plainly marked.

Another bearing job is seen in Fig 3 where an axle bearing lining for a motor is being bored in a special chuck. This is a split chuck that is contracted on the lining by compressing the outer jaws on the work. This tightening is done by the outer nut with the oblong holes, these holes receiving the end of a large spanner wrench that can rest on the outer ring during use. This ring is to retain chips, preventing them from flying all over the place.

Two Fixtures in One

A somewhat similar chuck, but one having a double use, is seen in Fig 4. This is for armature bearing housings as seen at the left resting on the table and the bench. The collar of this housing rests on the outer portion of the chuck while the large straight portion fits inside. The flange of the housing is clamped by the jaws shown with the clamping screws at the bottom.

The inner portion of the chuck holds the straight solid bearings of the type shown in place. This is held by the screws shown while being bored. This boring mill is kept set up for this work and handles these bearings in good time.

Axles and bearings have much in common, neither functioning without the other. The New York Rapid Transit Corp. axle practice is outstanding and shows the advantages of grinding over older methods of finishing. All axles are ground not only on the journals for the bearings, but also on the wheel seat, which is unusual in this country although said to be fairly common in England and in Europe. The grinder is shown in Fig. 5, which also shows one end of the racks used for storing them when between operations. Careful examination of the surfaces of the three axles on the rack will show a difference in the appearance of the wheel seats on the first and third. Both of these have had wheels removed while the middle axle is just as it came from the grinder.

Bearing life is said to be at least 25 per cent longer with ground bearings than with the usual rolled finish.

Comparing the surface of these wheel seats with those on axles finished by other methods there is a very noticeable difference. These show very smooth surfaces, very similar to the freshly ground axle except for slight dulling of finish due to the contact of the wheel. There is practically no deformation of the surface as is found where wheels are demounted from axles finished by turning and rolling. The better surface not only insures a more uniform mounting pressure but makes it possible to mount and remove wheels several times without appreciable dif-

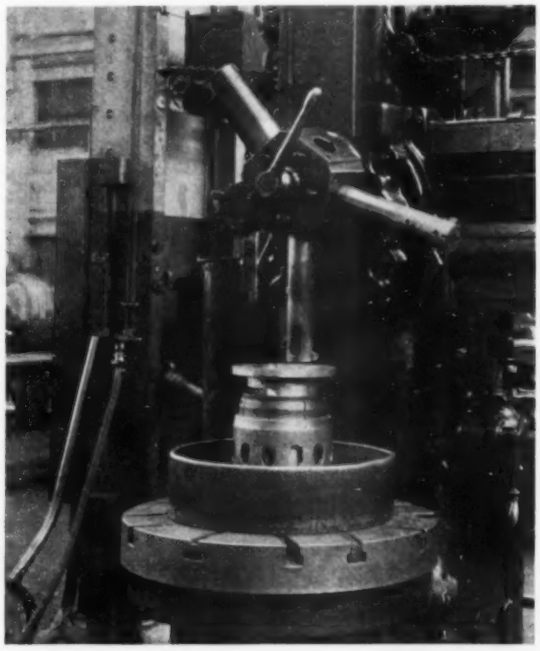
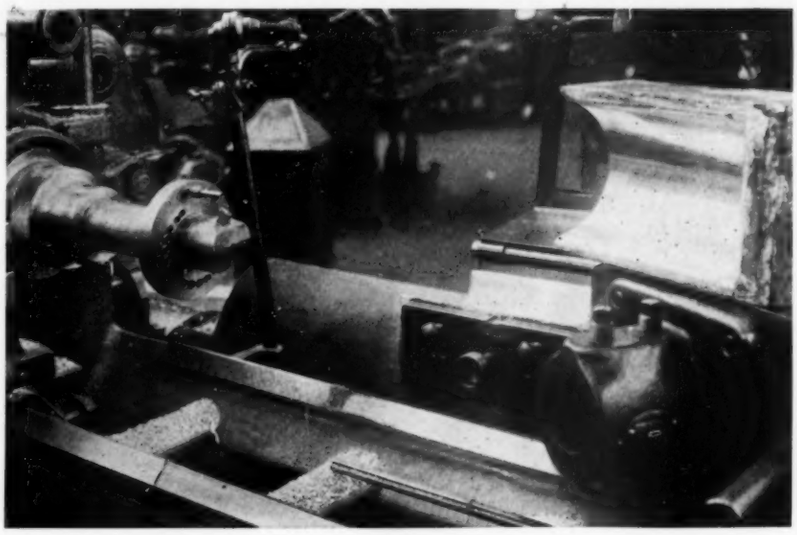


Fig. 3—Oblong holes in the nut allow use of a spanner to tighten the chuck jaws on the bearing liner

Fig. 2—A collar on the boring bar has a number of bushings to take the tool setting gage. Each bushing represents a given size of bearing



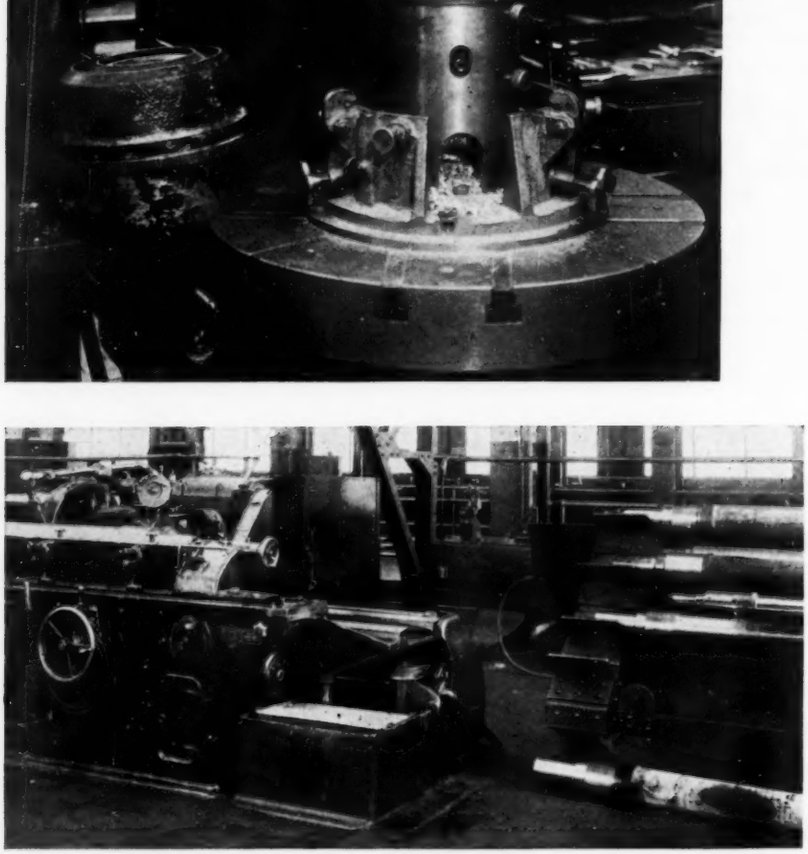
ference in the pressure that is needed.

A few examples of the pressures used for mounting may be of interest:

5¾ in. axles	60-85 tons
6½ in. axles	70-95 tons
8 in. axles	80-105 tons

Less pressure is used in mounting gears than wheels. For the same diameter of axle the pressure varies from one-half to two-thirds that used for wheels. This difference comes, of course, from the variations in the amount of metal between the wheels and the gears being mounted.

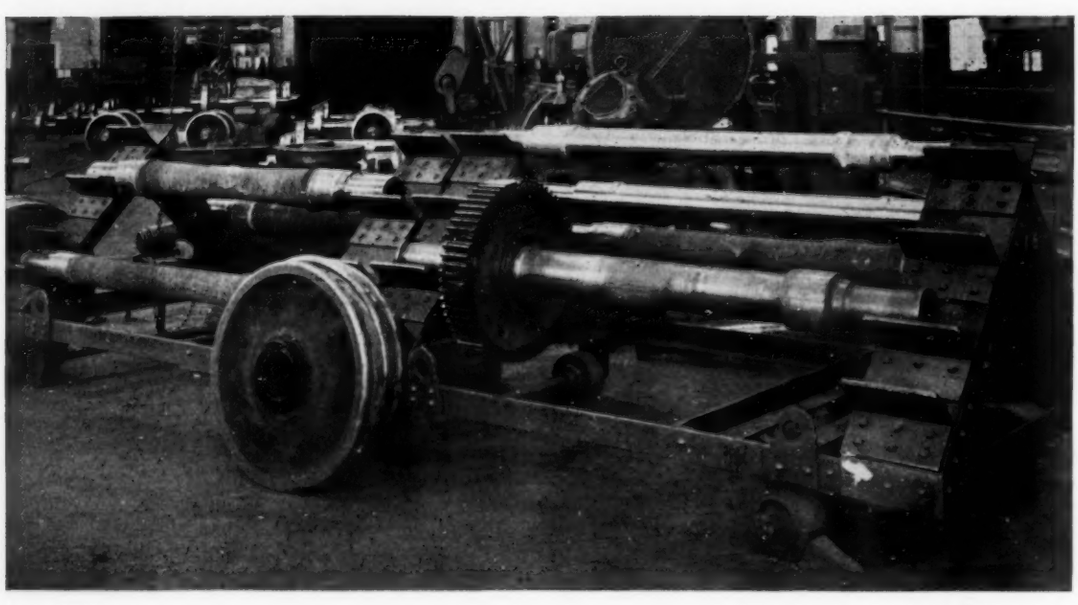
Special racks are used for storing axles before they are mounted with their wheels. Two of these racks are seen in Fig. 6. They are substantially built of steel plate, have small wheels for minor movements on the floor and eyes for crane hooks when they need to be carried from one point to another. This view shows several of the types and sizes of axles used.



• *Fig. 4—Two pieces are bored in this fixture. The armature bearing housing is held by the outer and lower portion, and the bearing liner by the central tall sleeve*

• *Fig. 5 — An unusual practice is the grinding of the wheel seats on the axles. The journals are also ground*

• *Fig. 6—Axles of several sizes and types are stored on this movable rack*



SHOPS and Their HABITS

FRED H. COLVIN
Editor

X—Like individuals, metal-working plants have their prejudices and idiosyncrasies; Mr. Colvin tells of some of them in the last of his series on his 50 years' experience as writer and editor

ONE phase of many of my contacts has been to note the way in which business segregates itself into rather narrow channels. Each branch seems to feel that its problems are so different from those of any other industry that machining methods must be different in every way. Gun makers, for example, are prone to make every part of the gun from drop forgings. Whether it be the receiver which holds the cartridge during the explosion of the charge, or the butt plate that goes against the shoulder of the gunner, both must be forgings. The band which holds the rifle on the stock, and the swivels that carry the fabric sling, are of forged steel—handicaps of traditions.

On the other hand it is quite probable that profiling machines, which play such a part in gun making, might be applied in fields that never seem to have thought of using them. Railroad shops have practices of their own, such as rolling axle journals and crankpins, where other builders finish by grinding.

Objections Overcome

Progress in machines and in methods has often been most erratic. Milling machines had a hard struggle to justify their existence, partly handicapped by the lack of good cutters and also because the necessity for rigidity in the machine was not appreciated. Grinding, which has made such spectacular advances, was held back by lack of knowledge of abrasive wheels and their possibilities. In the case of face, or cap wheel grinding, prejudice helped to delay its adoption. We had become so accustomed to straight lines on work traversed under a wheel that the multiplicity of curved lines had the appearance of deep scratches. This prejudice, according to my good friend Winslow Blanchard, designer of the grinder which bears his name, was a serious obstacle to the introduction of his machine.

The flat turret and new types of gear cutting machinery met all kinds of rebuffs and had to fight their way by sheer merit. Broaching grew from the lowly piece of steel with teeth filed on it, which we used to clean out sand cored holes to an oval or other shape. A husky hammer drove it through the hole. Machine broaching was used spasmodically in various parts of the country as a special operation, until Joe Lapointe made up his mind that there was a field for regular machines of this type. The last few years have seen great developments in both internal and external broaching, Joe Lepoint's sons playing a prominent part in this work.

Much of the impetus behind the development of special machines for various operations in building automobiles was due to Henry Ford, the Model T and the plant at Highland Park. Special machines for turning pistons by the Foote-Burt Co., special way-drilling machines by the same concern, milling machines that surfaced the ends of the very light front axles, and could do nothing else, were all shown in the series of articles I wrote in 1913 and 1914. These were, incidentally, the first process articles to come out of the Ford plant. I had visited the Piquette Ave. plant, where I first met Harold Wills, who was experimenting with, and developing, vanadium steel, before Highland Park was opened. Harold drove me out there from Piquette Ave. on a winter's day in a Ford coupe, the first closed car I had ever ridden in, and showed me the plant. But it was not until late in 1913 that he gave the word that the story could be written.

Inspiration Yields Results

Much of this development of special machines was due to close cooperation with the builders of machine tools who had reputations for producing results. I was told that Allen Foote of the Foote-Burt Co., whom I knew very well, spent considerable time in the Ford plant watching operations along his line. When he got an inspiration as to how a job could be done better, or cheaper, or both, he sketched up a machine for the work and submitted it for approval. Whether this was the exact plan or not, Henry Ford's desire for better methods and products, together with the opportunity presented by his phenomenal output, was responsible for many of our present-day methods and our progress.

Romance in Machines

Machinery, instead of taking the romance out of life as some contend, has served me in the opposite direction. Whether in the shop where more or less intricate machines grow into being almost by magic, or in such engineering creations as the Panama Canal, the mechanically minded cannot fail to get a thrill. And though I have been closely connected with machines and machinery for over 50 years, I still like to visit shops of all sizes. Perhaps it is a sort of disease—like buying tickets on the sweepstakes—hoping I might find something especially interesting in the next shop. Nearly every shop has at least one idea that has been developed by some mechanic to get himself out of a jam, or it confirms some phase of shop practice that has proved of value through the years. History repeats itself in the shop just as it does in styles of women's hats and fashions.

There is a danger however in being too cocksure about the many old-new ideas that crop up from time to time. We have all seen devices proposed as new that were tried, and failed, years ago. But it sometimes happens that men who didn't know of their previous failure have made them work. New materials and methods, or more knowledge, often does the trick.

BENDS in BLANK LAYOUT

▼

C. W. HINMAN

A GOOD START is half the battle. And it applies to die design as well as to anything else. Take the case of the small part shown in Fig. 1. It is used in conjunction with a ball stud for the adjustment of a deflector plate on an automobile heater. There are twelve bends in this part and allowance must be made for all of them if the work is to come out of the dies to the correct dimensions.

In making the blank layout shown in Fig. 2, use was made of the common assumption that the neutral bending line is one-third the distance from the inside of the completed bend. The bends are sharp. From a table of bend allowances it was found that 0.026 in. must be added to the inside dimension of each 90-deg. bend and half that amount for each 45-deg. bend in order to get the true developed length and width of the blank. The ball cups are less than hemispheres and did not require great accuracy. Therefore, they were made to the developed width of the body.

The next step was to determine the scrap allowance, the strip width, and the blanking centers. The width of the strip was taken at 6¾ in. While this width allowed ⅛-in. neck of metal on each side of the strip after blanking, the allowance was deemed a measure of safety in case of an increase in the length of the blank.

In Fig. 2 is a plan of the perforating and blanking die. The strip is run through the tools under a positive-type channel stripper plate attached to the die block.

The first forming and drawing tools are shown in Fig. 3 in closed position and with the work between them. Two blocks *A* work against springs in the die shoe, while the corresponding blocks *B* are rigidly attached to the punch holder. Blocks *C*, which carry the dies for forming the cups, are rigidly attached to the die shoe, and the corresponding forming punches are attached to the punch holder.

Block *D* is a spring pad and is a sliding fit inside of the blocks *F* and works against the forming punch *H*, which is actuated by a spring in the punch stem that is stronger than that in spring pad *D*. The blank is laid between four side-locating pins in blocks *F* and its endwise location is obtained by placing the 5/32-in. central hole over a pin in spring pad *D*. When the ram descends, the blank is first contacted by the punch *H* against the spring pad and draws and forms the work between blocks *A*. Thus far the length of the blank has been diminished on both ends, and the two blank ends for the cups have been brought into position under the forming punches.

As the ram continues its descent, the four sides (⅛ x 1¼ in.) are formed between blocks *F* and *A*, but when

▲

Get the bends right and the blank just can't help but form right

▼

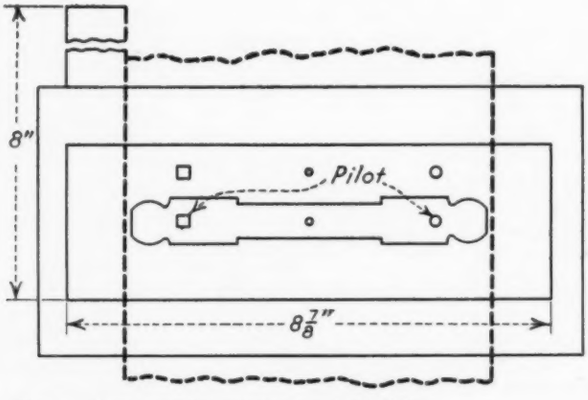


Fig. 2—A progressive piercing and blanking die assures an accurate blank through careful disposition of pilots

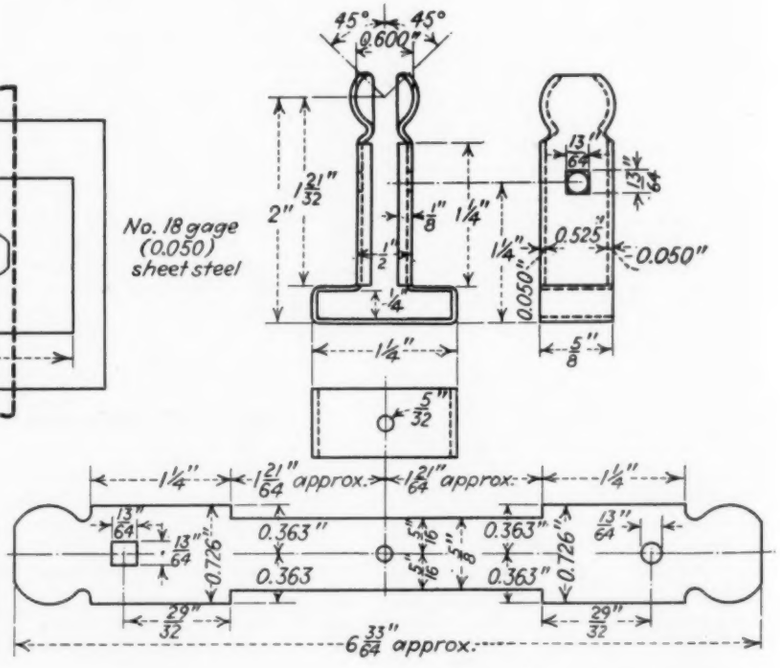


Fig. 1—At the top is the part which is to be riveted to the heat deflector shield. Below is shown the blank layout, all bend allowances having been included

spring pad *D* and blocks *A* finally register against the die shoe, the cups and the sides have been finished and the work in this operation has been completed. As the ram ascends, the spring pads and the blocks follow it up until stopped flush with the die, when the punch begins to leave the work. The three spring pads then eject the work from the die and an air jet causes the work to rise and clear the pilot pin and fall out the back of the press.

The tools for the last operation are shown in Fig. 4 in the closed position. This operation consists in folding up the long sides of the work to its finished height of 2 in. The work is laid in channel blocks *A* for side location, and its central hole is again placed over a 5/32-in. pilot pin. When the ram descends, punch *B* contacts the work on its face in which a clearance hole is provided for the pilot pin. As the ram continues to descend, the blank is forced between the sides of the forming channel *C*, and since only the thickness of the material is allowed on the sides for clearance between the forming punch and the die, the long sides must be forced up into completion.

No springs are used in these tools for the last operation. The forming blocks and the punch are rigidly attached to the die shoe and the punch holder respectively. The forming punch is relieved at its front, but not deep enough to impair its strength, and to a sufficient height to permit the long sides of the work to fold toward each other and flat against the punch blade without interference. The finished work is removed by the operator using a hand hook. The production did not warrant the extra expense of an automatic ejector. However, such a device could be attached. It could either be operated by a hand lever or by an air piston actuated by a valve operated by the ram ascent.

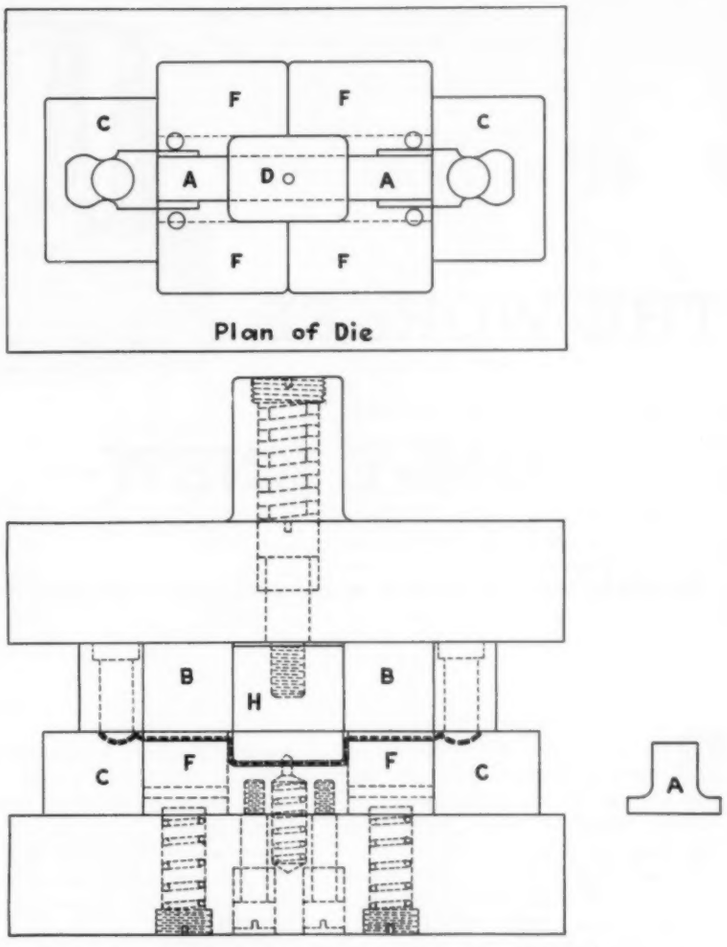


Fig. 3—In the first forming operation the blank is located sidewise between guide pins and endwise by a pilot pin engaging the central hole

"Sink Hobbed" Gears

The projected contact locus of Fig. 1 (*AM*—Vol. 80, page 657) was shown incorrectly. This contact locus, which is really a triply inflected spiral, should be tangential to the cutter axis at the intersection of the cutter and spool axes, and is once inflected there instead of acutely intersecting both axes at this point. The parallel lines outlining the projection of the elementary cutter cylinder are the asymptotes of this spiral.

Furthermore, in the third column of page 657 the third limit for the spool should read:

(c) When κ is $\frac{\pi}{2}$, the spool is toric.

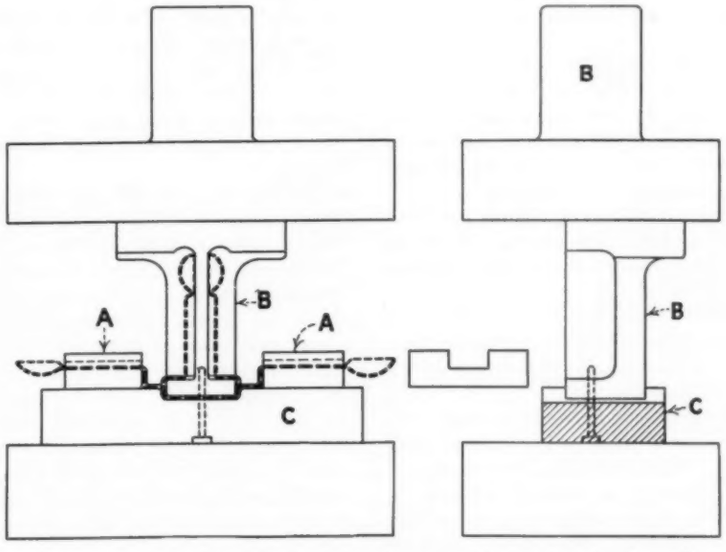
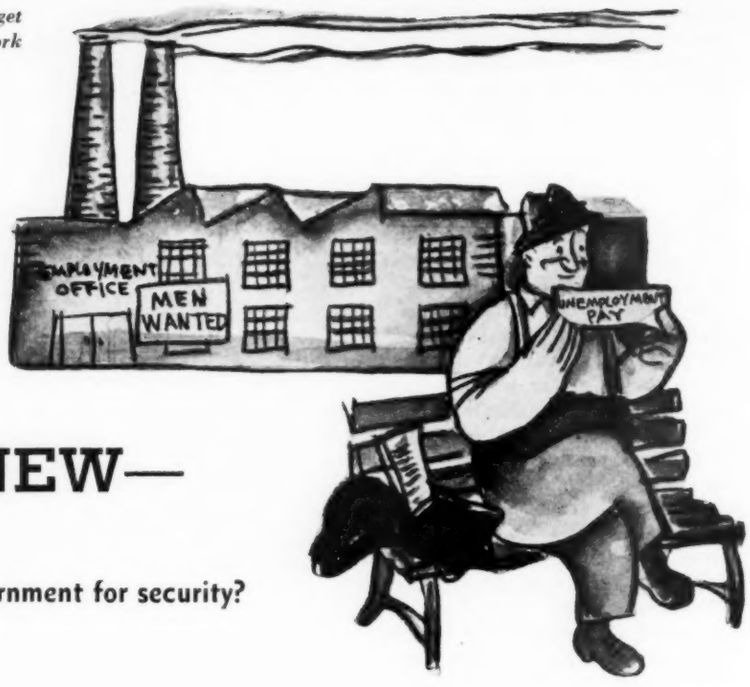


Fig. 4—In the final bending operation the blank is again located endwise by a pilot pin engaging the central hole. The long ends are bent upward, bringing the ball cups into correct position

. . . Some men would rather get unemployment pay than go to work

IF THE WORKER ONLY KNEW—



Would he want to depend on the government for security?

BIG BILL, the planer hand, was leaving the City Savings Bank when he met his co-worker Sam.

"Still salting it away?" said Sam. "I'd think you'd know better by now."

"What's better than having a nest egg to rely on when you're old or out of work?" asked Bill. "It's a mighty comfortable feeling to know you're independent."

"It used to be, Bill. But I don't see that it makes much difference now that the Security Act is passed. That sets up a plan to insure us against unemployment and pension us in our old age."

"Not so fast, Sam. If I understand the security law at all, it doesn't set up any plan. It just taxes payrolls and then allows a 90 per cent refund to states that set up laws for old age and unemployment compensation."

"That's just to get around the Constitution, Bill. The states will fall in line when they're taxed with nothing coming back."

"You're right there, Sam. But not all the states will have the same laws. Some of those passed already are pretty weak in spots."

"Well, I don't know about that. All I know is I think it's a darned good thing. When a man's thrown out of a job through no fault of his own he shouldn't have to depend on some hit-or-miss handout. Same's true when he gets too old to work. He should be insured against both."

"If real insurance plans were being set up, I'd agree. But most of the state schemes aren't that at all. They entirely ignore the 25 years' experience in England on job insurance. For instance, every European plan excepting Russia's makes the worker pay part of the cost. A lot of states aren't even doing that."

"That's all right with me. I've got expense enough now. I'd just as soon let the company carry the load."

"I don't believe you would, Sam, if you stopped to think it over. In the first place, you'd be paying for it indirectly anyhow. The tax the company pays increases the cost of production; you and I pay that in the things we buy. Another thing is that the tax tends to hold down wage rates, so in the long run we'll feel it on the receiving end too."

"I don't get you, Bill. If we're going to get soaked anyway what difference does it make if we pay directly or not?"

"Simply this. There's always a lot of people who'll try to beat any system. Some men would rather get unemployment pay than go to work. And it's good workers like you, Sam, who will be paying the bill. Now if we all have to chip in a little each week we'll see that the shiftless or downright crooked don't get away with it. But if we only contribute indirectly we won't take so much interest and the cost will go 'way up."

"I see your point, Bill. You'd have employers and employees split the cost."

"I'd go further than that, Sam. As it stands now employers will eventually be taxed six per cent on their payrolls. That's too much for a great many companies which are now operating on a narrow margin. If it forces some of these out of business the unemployment problem will be worse instead of better. We're putting practically the whole load on the ones who are giving jobs. That's not right because these things are not up to the employer alone. The workers and the general public also have part of the responsibility. I'd like to see pensions paid out of a general tax of some kind which wouldn't act as a brake on the size of the payroll."

"You've given this a lot more thought than I have, Bill. All I knew was the word 'security' and it sounded good to me. I can see it's got to be set up right."

"That's it exactly. Because if business and federal finances aren't secure there won't be any security for anybody. These so-called insurance plans run into billions of dollars and if allowed to run wild they can do a terrific amount of damage to everybody and especially the workers they're intended to protect. One of the greatest harms to the worker is to encourage the idea that he no longer needs to stand on his own feet—that thrift is old-fashioned."

"I guess I was getting that way myself, Bill. But you're right—I don't want to have to look to any part of the government for my living. I've got a little money saved up, too, and I'm going to start adding to it each week."

DIE DESIGN and DIE MAKING

XI—To get a form die right may take as much time as to build the die in the first place

E. G. MARSHALL
Master Mechanic, Charleston Works, The American Fork & Hoe Company

FORMED work is produced in dies having the upper and lower members machined to the shape of the part. The cavity or depression in the lower member fits one side of the part, and the punch the other side. After the blank is inserted in the die and located either by a nest or locating pins, the ram descends and the punch forces the sheet into the desired shape. This may be a simple bend or a complex irregular outline.

Most metals are elastic and will spring back to less than the desired form if the tools are not made to over form. The amount of spring back can only be determined by trial. Methods of compensating the dies will be discussed.

In sketch 1 in Fig. 47 is shown schematically the making of a single right-angle form. When the part is loaded the movable member *A* is at the same level as die block *B*, as indicated by the horizontal dotted line. To get a true right-angle form, the die block *B* and the punch *C* must pinch the stock and stretch the outer fibers so that the metal is thrown beyond a 90-deg. bend, as shown by the dotted line *D*. Thickness tolerance on the stock must be as close as possible in order to get a uniformly bent product.

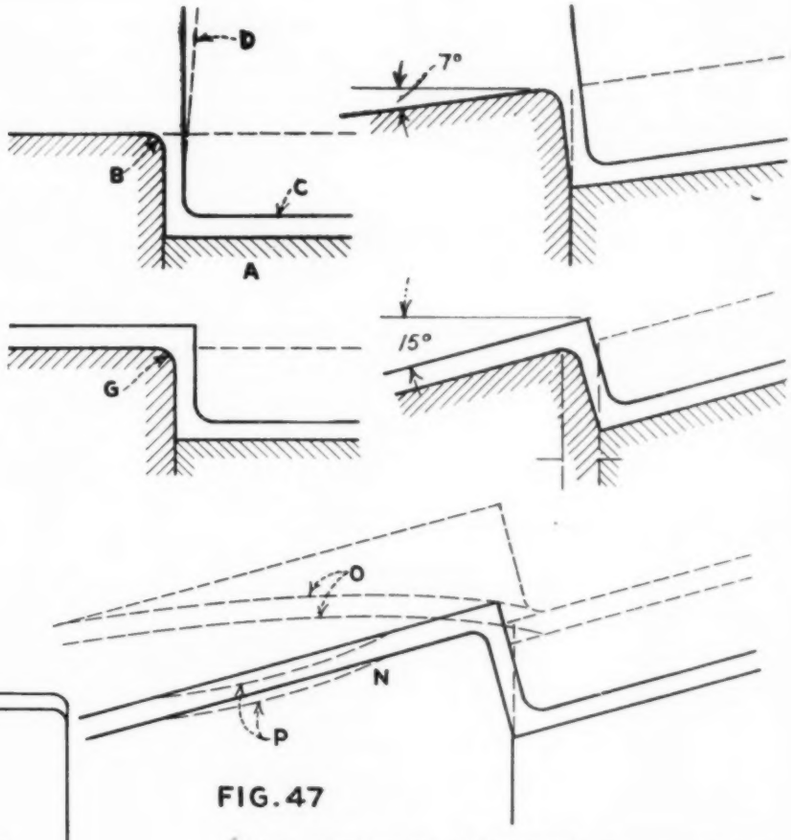


FIG. 47

Fig. 47—Overforming of sheet metal is necessary to overcome spring back. These five sketches show methods for single and double right-angle bends

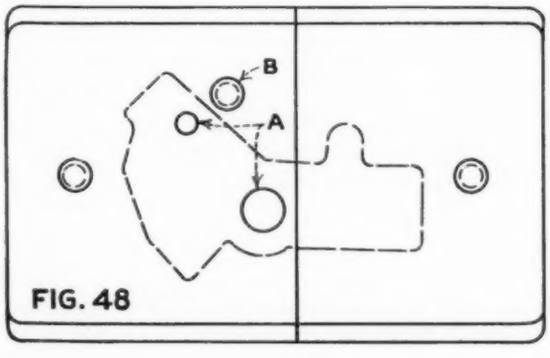
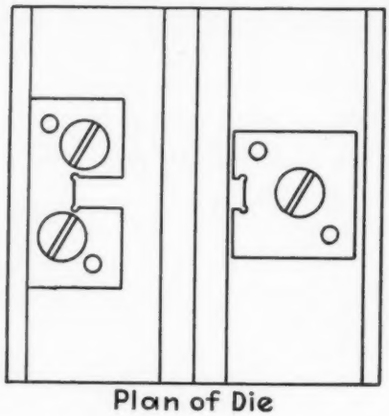


FIG. 48

Fig. 48—Two locating pins A instead of a nest can be used when making a form less than the stock thickness because the metal does not shorten. Pin B prevents the part being put in wrong side up



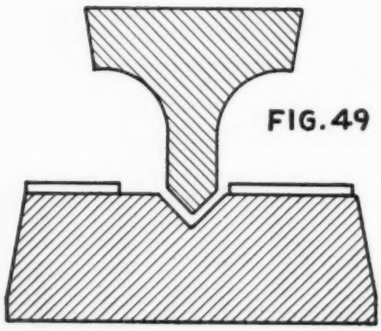


Fig. 49—After machining, the 90-deg. V's on punch and in die are ground to correct error in the part

By tilting the die block as in sketch 2, the stock is ironed on both sides of the bend and set in the desired position. It still will be necessary to grind the overthrow angle. In this type of die the thickness of the stock can vary more than in the previous example.

A double right-angle bend is shown in sketch 3. At the start the movable member *F* is at the position shown by the horizontal dotted line. As it moves down the stock used up in the bends must flow around radius *G*. The stretching of the metal produces changes that prevent accurate results.

Very often the stock is fractured, but with the die tilted as in sketch 4, the distance leaves less metal to flow around the radius in the die. Moreover, all three surfaces are ironed, whereas on a flat die it is almost impossible to iron the stock.

Dotted lines *O* in sketch 5 show how the stock bends when punch and die meet. The curve is sometimes not ironed out, and to overcome this condition the punch and die are dished as at *P*. When the metal springs back it will be straight. Use a large radius in the bend to ease the strain on the stock. Also, have the burr on the blank toward the form punch, if possible. It will save excessive wear on the die block.

Like other kinds of dies, form dies are made in many types and vary greatly in cost. For inexpensive setups, planish blocks are used. Such dies have been described quite fully. Here it will suffice to say that two rectangular blocks are placed together with the layout side up, are laid out, then machined to the line, and placed together with nest plates between equal to the thickness of the part. The designer should always lay out the angle of the part in the blocks so that the blank lies flat before forming. In the case of a double right-angle bend, the radius on the punch for the bottom bend should hit the stock first. Of course, the axis of the part will be at an angle to the horizontal plane. If the stock is hit first by this bottom radius, the metal will draw around that point. While such planish blocks will iron out the metal on all surfaces, the work will not be very accurate.

A first-operation, right-angle form die, called the "V-form" die, is shown in Fig. 49. This die is not recommended for use where close accuracy is required. It is made for use in universal holders.

The part is a rectangular piece of 1/16-in. cold-rolled steel. It is located on each end by nest plates. These are made of cold-rolled steel and case-hard-

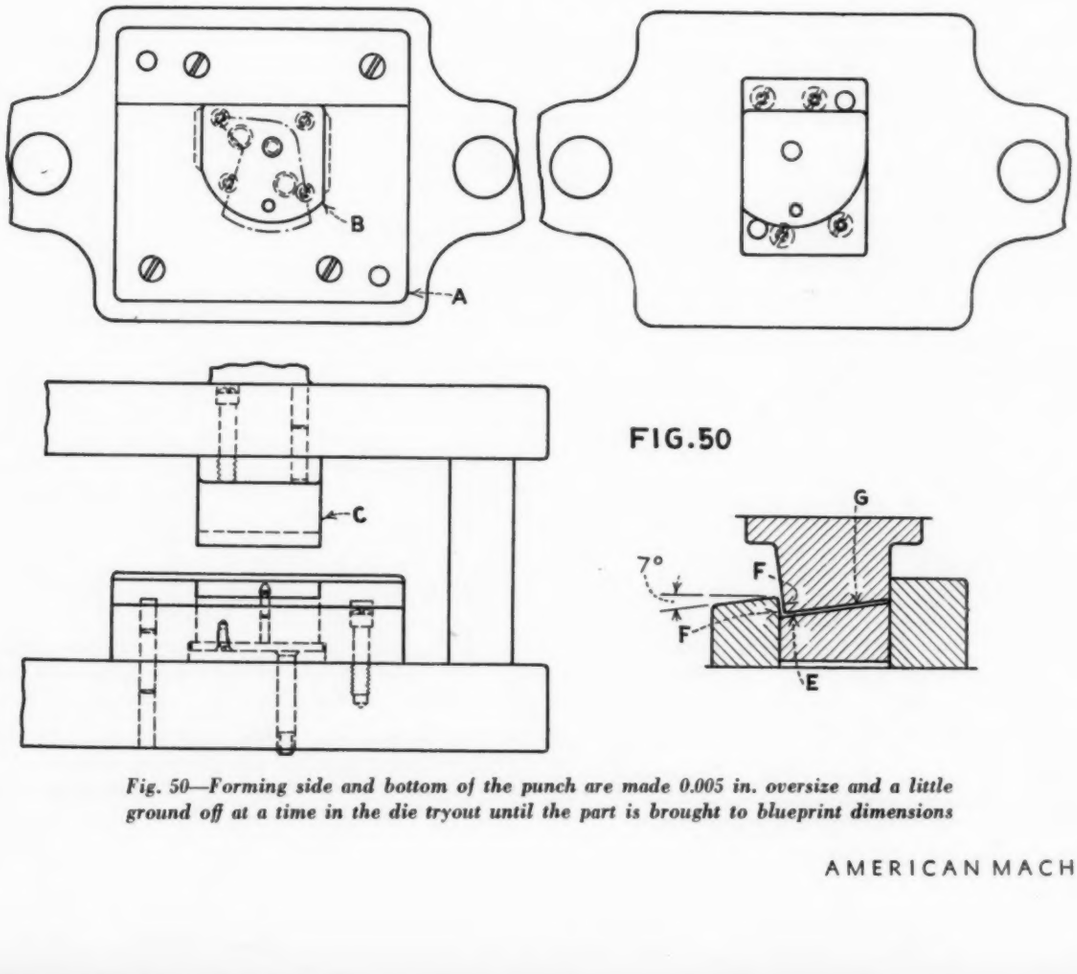


Fig. 50—Forming side and bottom of the punch are made 0.005 in. oversize and a little ground off at a time in the die tryout until the part is brought to blueprint dimensions

ened. They are located to suit the position of the form. The V-shape in the block and on the punch is machined to 90 deg. at the start, and ground to correct any error in the part. Both the punch and the die are made of water-hardening, wear-resisting tool steel.

For high production of accurately formed work the sub-press type of die is indicated. Fig. 50 is a working drawing for such a die, which produces a first-operation right-angle form. The top surface of the die is tilted 7 deg. so that the punch will iron the formed portion and the flat portion, and also set the metal. Pins locate the part in the movable member. After the part is placed over the pins, the press is tripped and the punch moves down and holds the part flat on the movable member. The movable member yields and moves down with the punch. Meanwhile, the end of the stock hitting the radius on the mouth of the die is formed back up. When the punch bottoms on the movable member and the die block, the metal is ironed out properly.

Die block *A* is made of water-harding, wear-resisting steel. It is roughed out in the rectangular shape, and the top angle of 7 deg. is milled or shaped. A heel is left on the back above the 7 deg. surface and is equal to 1/8-in. plus the stock thickness. This heel backs up the punch before the form starts. The opening for the movable member is laid out, a starting hole drilled, and the slotter works up to the line. There should always be plenty of clearance around the part, and it is not necessary to be very accurate in the shape of the opening. The walls of the opening are kept at right angles with the bottom of the die block.

The 7-deg. forming surface on the front of the die opening should be machined only where the part is formed in order to leave as much of the straight walls as possible to guide the movable member. Clearance is milled in the bottom for the retaining plate that holds the movable member. Holes are drilled and counterbored for the screws to attach it to the die shoe. Dowel holes are drilled and reamed, allowing metal for lapping, and the die block is hardened.

Movable member *B* is made of water-hardening tool steel. It is first shaped to a rectangle and then machined on the sides to be a snug fit in the hardened die block. The top is machined to a 7-deg. angle to be flush with the top of the die block when the retaining plate limits in the recess in the die block. The bottom of the retaining plate will be flush with the bottom of the die block at the end of the down stroke. Drill and tap the screw holes and attach the retaining plate. Then lock the movable member in the down position.

To bore the holes for the locating pins clamp the die block on the boring mill table with the top 7-deg. face parallel with the table surface. The holes can then be bored from the 7-deg. finished spot in the die block, allowing for the thickness of metal. This method will locate the part very closely, and if the work is watched from here on the part will be within blue-print limits. The movable member can now be hardened.

The retaining plate is made of 1/8-in. cold-rolled steel and casehardened. Drill holes in the lower member for the knockout pins. Attach the die block with the movable member inside to the lower member of the die set.

The punch *C* is shaped and finished to enter the die block opening, and a heel is left on top to hold the screws and dowels that attach it to the upper member. The forming side and bottom are made 0.005-in. larger than the final dimensions when stock clearance is allowed. This 0.005-in. of material is ground off a little at a time in the die tryout so as to bring the part to print size. Screw and dowel holes are then put in the punch as well as clearance holes for the locating pins. The punch is hardened and then mounted on the upper member.

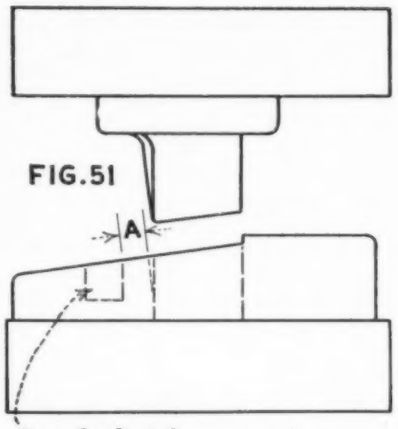


Fig. 51—When dimension A is thick enough to avoid breakage, this type of construction is preferable for second operation form dies

Knock-out pins are made of drill rod. The lower ends will extend 1/32-in. below the lower member when the movable member is in the up position. A hole is drilled and tapped in the lower member for the stud that holds the spring to operate the knockout pins. The completed die is then placed in the punch press and tried out.

An examination will show where the part has been pinched too much.

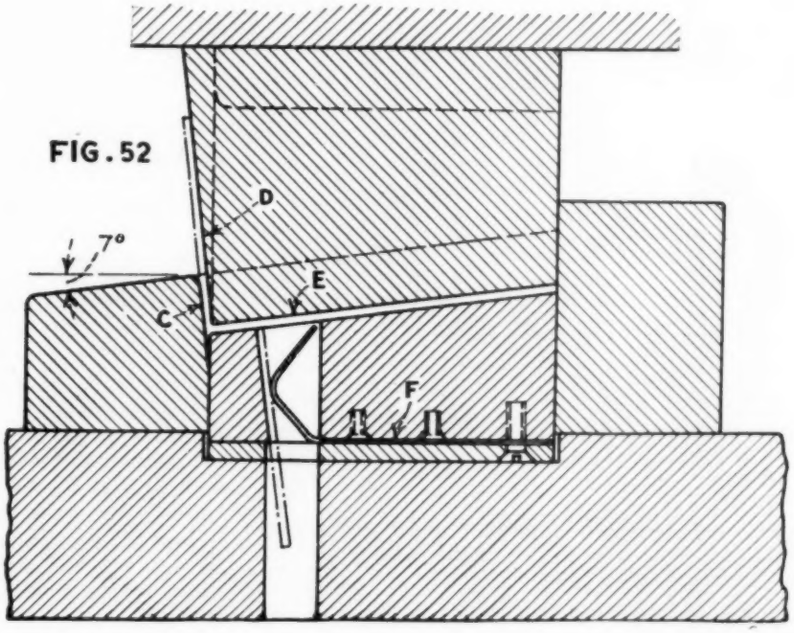


Fig. 52—One leg of a part with a single bend is put in the hole in the movable member. The second form is then made over C

Check the measurements on the part and grind the punch, the die block or the movable member. If the form is less than 90-deg., the angle on the die at *D* and the punch at *F* must be changed to allow the metal to overform and spring back. This condition can also be caused by the metal not being pinched hard enough between *D* and *F*. If the angle on the part goes beyond 90-deg., it may be caused either by pinching the metal too hard or because the angles *D* and *F* are wrong, allowing too much overform to occur.

If the form is too close to the holes, and the form is correct at 90-deg., examine the part to see how it bottoms on each side of the form. If it pinches too hard between *D* and *F* and is too close to the holes, remove some metal from the surface *D* in the die block. If it does not pinch hard enough between *D* and *F*, but is too close to the holes, grind some metal off the punch surface at *G*.

On the other hand, if the form is too far from the holes and is pinched too tight between *D* and *F*, grind some metal off the punch surface *F*. If it is too far from the holes and does not pinch hard enough at *D* and *F*, grind the bottom of the movable member at *E*. Be careful to grind a little at a time as it is possible to grind off too much material and make the condition much worse.

Some parts have two or more forms. Make the first form in a die similar to that in Fig. 50 and make the second form by the same method as the first form. Fig. 51 is a side-view sketch of one method in use. This can only be used when dimension *A* or the height of the form is large enough. Clearance must be cut in the die block for the first form and also the swing of the first form during the second form. If the height of the form is too small, the section *A* will be too weak and will easily break. On the second form care must be used that the metal is pinched evenly all the way across, or otherwise it will be thrown sideways. This method is also not very good if the end formed down is too long.

Fig. 52 shows another method for making a second-operation form. The part is located on top of the movable member and nest plates locate it sideways while the hole in the movable member, with the flat spring, locates it front and back. The hole in the movable member is laid out with the movable member and the die block in the same position as described in Fig. 50 when boring the locating-pin holes.

Some of the following troubles can be expected when the die is first tried out. If the height of the formed part from the main blank is too high, and the part is pinched evenly on both surfaces, remove metal from the punch at *D*, and the movable member at *F*. If the form is too high and the part is pinched too much between *C* and *D*, remove metal at *D*. If the form is too high and the metal not pinched hard enough between *C* and *D*, remove metal from the movable member at *F*.

If the height of the form is too low, and the metal is pinched evenly, remove metal from the die at *C*, and from the punch at *E*. If the height of the form is too low, and the metal is pinched too hard between *C* and *D*, remove metal from the die block at *C*. If the height of the form is too low and the part is not pinched enough between *C* and *D*, remove metal from the punch at *E*.

Assuming that the first form was in the correct position, the second form will be in the correct position also if the angles and height are right. If the second form angle is not correct the angles at *C* and *D* must be corrected. For otherwise the first form will not be parallel with the main flat surface. Uneven pinching will throw the metal sideways and must be corrected.

Two right-angle forms are made in one operation with the die shown in Fig. 53. The labor cost is half that of the two-operation method.

The top surface is tilted at a 15-deg. angle so that less metal must flow around the corner *A*. The radius on such corners should never be less than the thickness of the stock. The part is located by pins or nest plates on top of the movable member. In this case the punch must bottom on the top of the die as well as on the movable member. Machine the die in a manner similar to that described for Fig. 50 and watch for the following errors.

When the height of the form is too low: if the part is pinched evenly on all three surfaces grind the punch at *H* and the movable member at *D;* if the metal is pinched too hard between *B* and *H*, grind the punch at *H;* if the metal is pinched too hard between *D* and *E*, grind at *D*.

When the height of the form is too great, use the following procedure: first see if the form is too close to the locating holes or too far from them. If too close and pinched between *C* and *G*, grind at *C;* if too far grind at *G*. Grinding at *C* and *G* will not change the height of the form, but these dimensions should be altered before other surfaces are ground. But if the height of the form is too high and the metal is pinched evenly on all three surfaces, grind the die at *B* and the punch at *F*. If pinched too hard between *B* and *H*, grind the die at *B*. If pinched too hard at *C* and *G*, grind *C* and *D* to suit the distance the form is from the locating holes. If pinched too hard between *D* and *F*, grind the punch at *F*.

When the forms are too close to the locating pin holes, and the metal is pinched evenly on all surfaces, grind the die at *C*. If the form is too far from the holes, grind the punch at *G*. If the forms are too close to the locating holes and the part pinched too hard between *B* and *H*, grind the die at *B* or the punch at *H* to remove the pinching, then at *C* to make the distance longer. If the forms are too far from the holes, grind at *B* or *H* to remove the pinching, then at *G* to change the distance. If the forms are too close to the holes and the part pinched at *C* and *G*, grind the die at *C*. If too far from the holes grind the punch at *G*. The same applies if pinched at *D* and *F*. Grind to remove the pinching and then at *C* and *G* to change the distance.

If the angles are not correct, grind the end that is wrong. not at *C* and *G*. If the top and bottom are not parallel, grind the angle that is off.

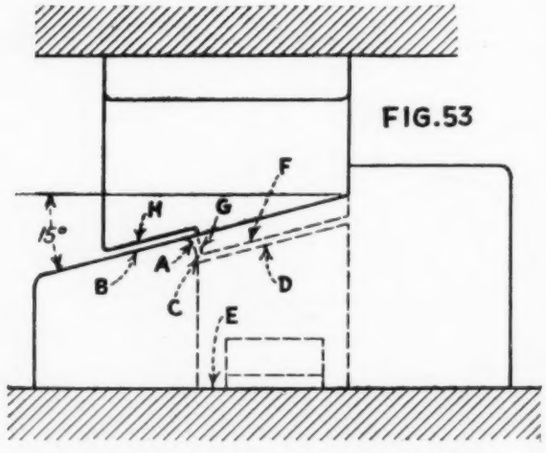


Fig. 53—Since the punch must bottom on the movable member and also on the top die face, this double right-angle die is hard to make, and it is difficult to get the forms right

Part XII of *Die Design and Die Making* will appear in an early number.

Editorials

AMERICAN MACHINIST ESTABLISHED 1877
VOLUME 80 NUMBER 18
K. H. CONDIT • F. H. COLVIN
EDITORS

LANDON ON LABOR

IN his speech of acceptance Governor Landon chose the controversial subject of labor organization as one of the few points on which to be specific at the moment. It seemed to us that no one could misunderstand what he said, and that the impartial position he took was the only sound position for a presidential candidate to occupy.

If party lines were drawn between employers and employees, one candidate might be expected to be against organized labor, while his opponent favored it. In that case this country would be divided into rigid classes such as are customary in Europe, and we would have more sets of resolutions like those passed by the "class conscious"Kansas labor federation.

But in a country where organized labor is a violently vociferous but numerically small group, and where the two-party system involves the inclusion in each party of many different economic groups, a successful president must recognize his obligations to the country as a whole. After three years of New Deal deference to organized minorities it is a relief to hear a presidential candidate express a sense of responsibility to all of the people.

Politically, Governor Landon is on solid ground in his labor stand. After all these years of agitation by experts it is hard to believe that the failure of organized labor to attract more workers to its standard is because of employer opposition. It is more reasonable to hold that the majority of the employed do not find organization necessary to get what they want from their employers. Also, that many of them who do want to organize prefer to choose their own type of organization rather than be regimented into one particular organization which has not always been too careful about the ethics of its leadership. There are certainly many more worker votes outside the organized labor ranks than inside.

Leaders of the union group that is out to re-elect President Roosevelt have been quick to find fault with the Landon labor stand. The Socialist candidate has written for an explanation, which was promptly forthcoming. In it Mr. Landon excludes from his definition of coercion the ordinary activities of a labor organizer. This will not appeal to some of the more reactionary employers, but it will be accepted by the great majority who wish to be as fair to their employees as they are to their stockholders and to their customers.

WE hark back to the days when NIRA was still in committee, and when Section 7 (a) was under discussion. We said then that the fatal weakness of that section was that it protected the worker from employer coercion but not from coercion by labor racketeers. We held then, as Governor Landon holds now, that there must be no coercion from any source in the relations between the worker and his employer, and we see no reason to change now.

Foreign Business

MACHINE tool sales set a new record for the recovery period in the report for July just issued, and announced on one of the following pages. In fact, the record is within a few points of the 1929 monthly average.

Domestic business receded slightly from the June level but the loss was more than made up by the foreign orders received. Returning travelers report that machine tool plants in Germany and England are months behind on orders and that buyers are therefore turning to the United States as the only other important source of machine tools.

It would be comforting if we could believe that this activity represented a healthy improvement in business conditions, but we know that war scares are responsible for a large part of it. Germany's exports of machine tools are rising a bit as her own armaments plants are rapidly becoming modernized. In England on the other hand, the long-deferred defense program is making demands on her machine tool industry that are practically excluding commercial orders. When Mussolini called her Mediterranean bluff she got a very rude awakening to the danger of her position.

It is hard, of course, to refuse orders from any source when men here are out of work, and when there is such a gaping depression hole in the profit curve to be filled in. We can at least be honest with ourselves, however, and admit that we are helping Europe to re-arm.

Chips

WASHINGTON—Congressional experts study federal tax structure seeking to eliminate "nuisance" and unequal levies, and to modify taxes which have administrative disadvantages which outweigh their revenue yield, but Republican leaders scoff at New Dealers' economy talk . . . Plan to store bumper crop surpluses against lean years is feature of new farm security legislation being shaped by AAA experts for congress . . . Main PWA program halted pending clarification of new policy . . . "Robbing Peter to pay Paul" tactics makes Treasury report for first month-and-a-half of 1937 fiscal year look rosier than facts would warrant.

FOREIGN—U. S. lifts several countervailing tariffs after Germany abrogates subsidies on her exports, but exporters agree move is wholly insufficient to prevent continued shrinkage of German trade . . . French chamber of deputies adjourns after all-time speed record in passing 65 laws in ten weeks, most of which is enabling legislation for Premier Leon Blum's "new deal" program upon which he was swept into office last May; 44-hour week, collective bargaining, paid vacations, nationalizing armaments manufacture, reorganization of Bank of France to help finance social reforms and forming wheat and coal price control boards, were some of laws passed . . . Wholesale price index in Great Britain rises to highest point in six years . . . Huge oil, tobacco and other industrial properties siezed by Spain and turned over to workers in further effort to stop flight of capital to rebel forces as hard fighting continues through the sixth week of civil war . . . British cooperation with U. S. in product standardization, particularly in machinery field, is expected to spur our sales to Latin American countries.

FINANCE—Bank clearings 5.3 per cent above those of a year ago . . . Railroads have repaid $64,000,000 to RFC during first seven months of year, more than repayments during any preceding twelve months for last three years, indicating end is in sight for the government's emergency financing organization . . . Commercial loans at highest point since end of 1933.

INDUSTRY—Steel industry lumps orders for more economical production, as all-time peak in employment is recorded in June although industry's operation only 70 per cent of capacity . . . Appellate court affirms the Remington-Rand, Inc. injunction limiting strikers at Syracuse plant to four persons, the first high ruling on New York's 1935 Anti-Injunction law . . . Navy opens bids for nine fighting ships, finds costs up materially . . . Auto industry rushed far beyond expectations by continued strong demand for used cars, hampering 1937 model plans . . . Domestic electrical appliance sales break all records for first half . . . Best fall business since 1930 in prospect as retail business prepares for another upswing . . . Machine tool sales rise above 1929 monthly average in July, bolstered by exports; inquiries continue brisk, skilled labor becoming scarcer . . . First half shows 12.5 per cent reduction in commercial failures as compared with like 1935 period, lowest since 1920.

INDICATORS—Pig iron production for first six months up sharply to 13,367,785 tons, compared with 11,070,861 for like 1935 period . . . *Business Week's* index off 1.3 points, standing at 77.2.

Watching Washington

Campaign now gains momentum . . . Dickinson a New Deal spokesman . . . Roosevelt tours drought region . . . Spurt in equipment and construction foreseen . . . Odds against big war, despite threat

WASHINGTON—Election Day less than ten weeks away, the presidential campaign made a belated start with Governor Landon's home town address at West Middlesex, Pa. The Republican nominee reaffirmed his faith in free enterprise, declared that the American people could find security and abundance without sacrificing "any of our precious heritage of freedom." President Roosevelt, visiting first last Spring's flood areas then this summer's drought areas, continues his "non-political" talks and gives no real indication that he is running for office.

Administration's principal campaign speaker on business subjects will be John Dickinson, assistant attorney general in charge of anti-trust investigation, former assistant Secretary of Commerce. During his recent tour of Pennsylvania, he made nine speeches, played for the keystone state's business vote in the following points:

Cites Gains, Mum on Prices

Greatest benefactor of three short years of recovery is American business . . . Rehabilitation of banks, business loans, restoration of consumer purchasing power, in fact every major administration policy has promoted business welfare . . . Du Pont's 1935 earnings were 150 per cent greater than 1932; General Motors earned 1,000 times more in 1935 than 1932; International Harvester lost $7,000,000 in 1932, earned $20,000,000 in 1935 . . . Securities on N. Y. Stock Exchange have enhanced $30,000,000 . . . Business failures, at the rate of $1,-000,000,000 in 1932, were 80 per cent less than 1935 . . . Administration increased farm income by $3,000,000,000, creating an effective demand for manufactured products . . . 5,000,000 workers have been reemployed by private industry . . . Homes were saved from foreclosure and the insurance companies rescued from inevitable disaster.

In short there has been a degree of recovering, according to John Dickinson, and the Democratic administration made it possible. What he did not mention was the effect of high prices on curtailing consumer buying power. Food prices, higher than the war period, when considered in relation to wages, are predicted by Washington experts. An advance of fifteen per cent over August 1 is expected.

Despite the much heralded action taken by the administration, the drought is expected to be a liability to Roosevelt. Increased living costs will cause wide dissatisfaction. In rural areas there are many who believe that the administration went against God in killing pigs and limiting production. Essential varieties of wheat will have to be imported—cattle feed, too. This makes American farmers see red.

Washington economists foresee marked increase in industrial construction and equipment purchases. Here also are rising prices predicted. Added to the price increases that have already taken place, this is expected, to have strong stimulus on production. Equipment obsolescence can no longer be ignored. European rearmament has made many manufacturers realize that they did not have the capacity they thought they had. German machine tool makers are currently quoting 1938 deliveries. Twelve months is a common commitment on many kinds of British machinery.

Should war break out in Europe, depression and unemployment in the U. S. would promptly disappear. Judging from experience at the start of the World War the period of uncertainty at the beginning of the conflict would be of short duration. Prices of commodities and securities might toboggan for a few days but would soon regain their losses and rise to higher levels.

No stimulus to American business equal to 1915 is expected, but buying in this country would create a substantial prosperity. European countries would be unable to finance purchases with money borrowed here; they would be limited by the gold they would be willing to use and by the sale of American securities commandeered from their own nationals.

Oil, copper, steel, cotton and certain foodstuffs would be among the first to feel the effects of buying; most heavy industries soon would be operating at or near capacity.

Any temporary advantage that would come from such a development would be more than offset by the inevitable aftermath. In Washington, prevailing feeling is that chances are against a general European war now.

No one in Washington is busier than the average manufacturer agent. Uncle Sam, a $5,000,000,000 customer, is increasing his purchases. Governmental buying is a kaleidoscope of regulations, personalities and needs, whose pattern can change overnight.

Under a law which dates from 1861, all purchases and contracts for supplies and services for any governmental department are made by advertising for proposals. The only exceptions are the "personal services" and in cases where "public exigencies" require immediate delivery.

All governmental purchases are made against requisitions which originate with engineers, shop superintendents, repair shop foreman, office managers and officials of medical military and naval branches of the federal service.

Difficulties Are Many

Until the government came into the market as the nation's greatest single buying power, many manufacturers were not interested in federal purchasing. Now there is keen realization of the Washington demand, but it is coupled in many instances with discouraging memories of rejected bids and specifications which seem to bar future business.

An offset to any defeatist attitude on the part of American manufacturers is the modest headquarters opened in Washington by the National Association of Manufacturers' Agents. This organization is carrying on an extensive campaign to increase the interest of all manufacturers in the government as their greatest potential market. Last year the association contacted some 216,000 manufacturers doing a gross business of at least $5,000 to impress on American industry the profit in meeting governmental demands.

U.S. Wants Industry To Make Munitions

Nationalizing of War Materials Factories Would Fail

According to Major General William H. Tschappat, chief of ordnance, the War Department is opposed to the nationalization of munitions factories. In an article published in *Army Ordnance*, the journal of the Army Ordnance Association, he assumes to give this as the department's unqualified stand.

"The War department is convinced that in the event of war, American industry must produce the major portion of the required munitions," General Tschappat wrote. "Assuming this premise, it follows that so far as practicable industry should be prepared for its war mission.

"Therefore, the War Department has consistently favored the participation of American industry in munitions' manufacture and has encouraged the production of munitions, not only for the United States Government but also for export, where such export is not contrary to the policies of the State Department and does not divulge vital military secrets of design.

"This policy has been followed because it is believed that an organization or industry that has produced munitions in peace will be better qualified to produce munitions in war.

"For these very reasons the War Department does not favor the nationalization of munitions manufacture; that is, the full manufacture in government establishments. Such a policy would fail in war and therefore does not appear logical in peace."

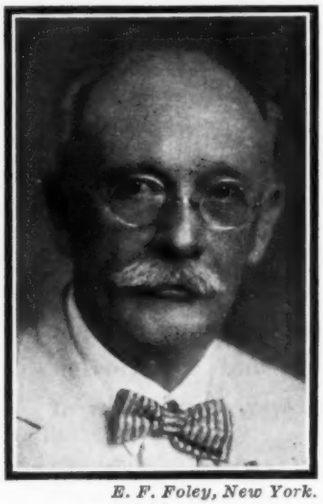
Price fixing is a major element in eliminating excessive war profits, but it is not the only element, he said. Price fixing alone cannot accomplish the desired result. It must be supplemented by reasonable and effective procedure in letting contracts and also by excess-profits taxes.

To Inspect Plants At Niagara Falls

Plant inspection trips will be a feature of the Niagara Falls, N. Y., meeting of the American Society of Mechanical Engineers, Sept. 16-19. The meeting headquarters will be in Hotel Niagara.

Technical sessions will be devoted to power, transportation, fuels, hydraulics and other subjects.

Electrical Manufacturer Dies



E. F. Foley, New York.

EDWARD WESTON

Manufacturer, scientist and inventor, DR. EDWARD WESTON, who established the first factory to manufacture dynamos in this country in 1875, died Aug. 20 at the age of 86.

In 1888 he founded the Weston Electric Instrument Co., Newark, N. J., and was credited with more than 300 patents on electro plating, power generation, instruments and other mechanical devices.

A native of England, he began a medical education but gave it up for electricity. He came to the United States when 20.

Merger Forms Largest Producer of Plastics

Leading Firms Unite as Unyte Corp., Executives Remain

Unyte Corp., New York and the Plaskon Co., Inc., Toledo, have been merged under the name of the latter.

J. L. Rodgers, president of Plaskon, will continue in that capacity and W. P. Pickhardt, former president of Unyte, becomes a director. Both firms are manufacturers of urea-formaldehyde resins. The merger makes the new company the world's largest producer of that material for the plastics industry.

KNIGHT BUYS PLANT

The Knight Screw Products Co., Detroit, has purchased the plant of the McAleer Mfg. Co. at Lyndon and Prairie Avenues and will occupy it by Sept. 15. The company has plans for building an addition to the plant in the near future.

German Auto Industry Shows Sharp Recovery

Quarter Million Cars and Trucks Will Be Year's Total, Belief

With automobile production increases in Germany during the first quarter beyond preliminary estimates, the industry now expects to produce more than 250,000 cars and trucks, against a total of a little over 200,000 during 1935.

Opel, a General Motors Corp. subsidiary, and Ford will produce more than a half of the total, with the Auto Union, the combine of Horch, Wanderer and D.K.W.; Adler and Mercedes Benz accounting for the major share of the balance.

Hansa, B.M.W., Hanomag and Stoewer factories have been active in the recovery, the latter having been acquired recently by Ford.

The German automobile manufacturing rennaisance dates back to the beginning of the world depression in 1929, when independent spring suspension and front-wheel drive models gave the industry, which had been all but exterminated by the World War, a new lease on life. Several mergers helped the remaining factories to continue, although the sharply reduced demand for new cars and almost negligible exports reduced the operations to a total of 48,000 cars and commercial vehicles in 1932. A 100 per cent increase in 1933, a total of about 150,000 in 1934 and crossing the 200,000 mark in 1935 have brought the industry back. Most of the factories have expanded recently.

As in this country, the volume production is among the smaller models.

TIMKEN TO OPEN PLANT

Waukegan Axle Factory Will Be Opened Sept. 1

Timken-Detroit Axle Co., Detroit, will establish a new plant at Waukegan, Ill., about Sept. 1 to be operated as a department under supervision of the company's Wisconsin axle division located at Oshkosh, Wis.

WELDING CLINICS

Clinics demonstrating the latest developments in welding non-ferrous alloys will be held in Cleveland Sept. 18 and 19, and in Buffalo Sept. 25 and 26, under the auspices of International Nickel Co., Aluminum Co. of America and Revere Copper & Brass Co. Engineers of these companies will conduct the clinics.

S.A.E. Aero Meet to Show Metal Working Advances

Newest Developments Will Be Explained At Los Angeles, Oct. 15-17

Latest developments in press work, stamping, forming machining and fabricating form the bulk of the program of the first aircraft production meeting ever staged, which will be under the auspices of the Society of Automotive Engineers, Inc., with the cooperation of the Aeronautical Chamber of Commerce of America, Inc., the Air Transport Association of America and the four Pacific Coast sections of the S.A.E., John A. C. Warner, secretary and general manager, announced. The sessions will be held Oct. 15-17 in Los Angeles.

With commercial and military aircraft production materially ahead of last year, many factories are adopting mass production methods, such as widely used in the older phase of automotive output, in automobile and truck factories.

Heretofore only a few craft of a given type have been needed at one time, and earlier manufacture was largely by use of hand methods. Higher production schedules, however, are calling for more manufacturing machinery and equipment.

Carleton E. Stryker, chief engineer, Curtiss-Wright technical Institute, is general chairman of the meeting, which will be held in the Ambassador Hotel. Mac Short and Opie Chenoweth, S.A.E. vice-presidents in charge of aircraft and aircraft engine activities, respectively, have been active in working out the plans with a committee of aeronautical executives on the Pacific Coast. Preliminary plans for the meeting were laid by Ralph R. Teetor, S.A.E. president, William B. Stout, past-president, Mr. Stryker and Mr. Warner.

Acetylene Association Announces Convention

The International Acetylene Association will hold its 37th Annual Convention Nov. 18 to 20, at the Jefferson Hotel, St. Louis. Technical sessions will be held each afternoon and two evenings, embracing welding and cutting developments. A form on welding and cutting, and a round-table session will be features.

WASHER MAKERS TO MEET

Members of Plain Washer Manufacturers' Association will meet Sept. 14 and 15 at Hotel Statler, Cleveland. A golf tournament has been planned for the closing day.

Manufacturing Gains, But Is Below 1929

1935 Total 35% Less Than Six Years Before

Income derived from manufacturing amounted to $11,748,000,000 in 1935, according to preliminary figures just published by the National Industrial Conference Board. Salaries and wages represent over four-fifths of the income disbursed in manufacturing. Dividends account for about 15 per cent and other items, such as interest and rent, for only 5 per cent.

Income in manufacturing declined from $18,058,000,000 in 1929 to $8,428,000,000 in 1933. In 1935 it was still approximately 35 per cent below the 1929 level, part of the decline being the result of the drop in prices.

The greatest declines in income between 1929 and 1933 occurred in the heavy or producers' goods branches of manufacturing. The construction material group was most severely affected by the depression. Income in the metal and metal products group was likewise curtailed more than the average.

MALAYAN IMPORTS UP

Increased activity in tin mining and oil producing have been reflected in substantial gains in U. S. exports of machinery to British Malaya, the Department of Commerce reports, giving the 1935 total of $543,000, or about one-sixth of the imports of machinery from all countries, an increase of 69 per cent over 1934.

Industrial Review

• HELPED somewhat by urgent foreign demands for deliveries, machinery and machine tool orders have been well maintained during August. Inquiries are very active in every industrial center and orders are being taken at a satisfactory rate. Shortages of skilled machinists in most cities are worrying managements. Strikes in Cincinnati and Oakland are the exceptions in an otherwise placid labor situation.

• IN THE EAST, Boston reports August business at the level of the last three months. Extended deliveries are causing some annoyance. Vacations have affected buying somewhat in and around New York, but there are plenty of inquiries to work on and many of them are being closed. Delayed deliveries are also tending to slow things down a little in the Philadelphia territory but prospects are excellent. In Pittsburgh the labor situation is touchy, thanks to the C.I.O., but buyers are talking machinery and placing orders just as if it were late fall instead of midsummer.

• CLEVELAND reports a substantial volume of business being placed with every evidence that the situation will remain unchanged for several months to come. Skilled men are extremely scarce. Labor conditions are quiet in Cincinnati except for the Remington-Rand disturbance. Machine tool orders are coming in steadily and prospects are bright for a vigorous fall business. St. Louis reports a slight slackening in orders but attributes it to the continued high temperatures which have slowed down everything. Inquiries are good.

• JULY WAS BETTER than expected in Detroit and August is holding up well. Tool shops are very busy and supply business is excellent. The labor situation, both here and in Toledo, is quiet. Toledo reports very active machine tool inquiries and plenty of orders. Chicago and Milwaukee expect excellent business during the last quarter. Summer records have been unusually good. Labor troubles are of no consequence, but there is a serious shortage of qualified men.

• EXCEPT for continuation of the Oakland machinists' strike, Pacific Coast industrials are showing activity which more than offsets pre-election slump. Revival in lumbering in the Northwest, a reflection of increased building, has resulted in the placing of machinery orders and a bright outlook. Airplane manufacturers around Los Angeles are still running at capacity. San Francisco was encouraged by local shipyards submitting low bids on two destroyers. In the Oakland strike, however, 800 machinists are still out of work.

Machinery Output at Recovery Peak

Machine Tool Builders' Index Touches 150.1

Climaxing seven months of consecutive gains, the July machine tool sales reached a new high for the recovery period, reaching 150.1, within five points of the 1929 average of 155, the National Machine Tool Builders' Association index, below, shows.

Foreign shipments doubled during July as compared with June, that portion of the index standing at 45.7 for the month, a new high for the year, and except for August, 1935, the high for the past twelve months. Reports from overseas indicate that war rumors have led to crowding foreign machinery manufacturing plants to capacity, and an unusual demand has been made on U. S. manufacturers.

World industrial recovery, however, is accounting for some of the strength shown by the association's report.

BUSINESS ITEMS

Greenfield Tap & Die Corp., Greenfield, Mass., has appointed Elliott C. Paddock field sales manager, a new post. He has been Connecticut and Western Massachusetts representative of the company.

Eclipse Counterbore Co., Detroit, has named F. G. Jackson Chicago district representative. Mr. Jackson has been representing Kearney & Trecker, Milwaukee, in the Philadelphia, Detroit and Chicago territories for the past 10 years as district sales manager.

Robbins & Myers, Inc., Springfield, Ohio, has appointed Ralph C. Smith manager of sales for the company's hoist division, Chicago.

Stainless Engineering & Machine Works is a new division formed by Cooper Alloy Foundry Co., Elizabeth, N. J., to supply specialized machine work adapted to stainless and heat resisting metals. Harry A. Cooper is president, and M. J. Roberts is general manager of the company.

Medart Co., St. Louis, power transmission machinery manufacturers, has appointed George S. Denithorne sales representative in Philadelphia; John M. Tizel, Pittsburgh representative; James W. Anderson will take charge of a new Chicago office, and Walter G. Kessling has been assigned to Dallas.

New Britain-Gridley Machine Co., a subsidiary of New Britain Machine Co., New Britain, Conn., has been terminated as a corporation, and business will be continued by the parent concern.

Reed-Prentice Corp., Worcester, Mass., has appointed Sterling-French Machinery Co., New Center Bldg., Detroit, exclusive sales agents for its line of machine tools.

Stedfast & Roulston, Inc., 156 Oliver St., Boston, machinery merchants, has appointed Owen C. Stevens, formerly with R. K. LeBlond Machine Tool Co., its Springfield representative.

Table I—Index of Machine Tool Orders

Based on Volume of Shipments for 1926

Month	Index of Orders: Domestic	Foreign	Total	3 Months' Average Index	% Foreign to Total Orders
1935—May	57.3	16.0	73.3	67.1	21
June	75.5	15.6	91.1	76.7	17
July	82.5	37.3	119.8	94.7	31
August	78.2	47.6	125.8	112.2	37
September	54.1	25.9	80.0	108.5	32
October	79.5	23.4	102.9	102.9	23
November	79.2	19.4	98.6	93.8	19
December	78.1	20.2	98.3	99.9	21
1936—January	95.7	15.1	110.8	102.6	14
February	99.8	12.3	112.1	107.1	11
March	89.0	16.3	105.3	109.4	15
April	110.9	14.8	125.7	114.4	12
May	95.7	23.2	118.9	116.6	19
June	106.5	22.3	128.8	124.4	17
July*	104.4	45.7	150.1	132.6	30

Table II—Distribution of Orders

Average Indexes of Individual Companies	Companies in Per Cent of Total Number Reporting: 1935, by Quarters: 1st	2nd	3rd	4th	1936: 1st	2nd	July
200-up	40.2	5.8	14.2	11.3	13.0	17.2%	19.3%
100-199	12.5	15.8	22.1	24.3	24.6	32.6	28.3
60-99	16.9	22.0	17.2	21.7	22.4	19.0	26.2
20-59	39.6	31.2	31.6	27.7	26.5	21.8	17.2
Less than 20%	26.8	25.2	14.9	15.0	13.5	9.7	9.0
		100.0	100.0		100.0	100.0	100.0

A.S.M.E. to Sponsor Welding Sessions

Metal Congress Program Scheduled For October 23 and 24

The American Society of Mechanical Engineers will sponsor four technical sessions on welding during the Metal Congress, Oct. 23 and 24, at Cleveland. The first two sessions will be held jointly with the American Welding Society.

EXPORT OPPORTUNITIES

Tools, hand and small electrical. (Agency) Amsterdam, Netherlands. *1303.

Engineering workshop machinery and supplies, mill supplies and machinery. (Purchase and agency.) Calcutta, India. *1301.

Textile and mining machinery and equipment. (Agency.) Mexico City. Mexico. *1311.

Textile machinery and equipment. (Purchase.) Monterey, Mexico. *1312.

Machine Tools. (Agency.) Amsterdam, Netherlands. *1303.

Woodworking tools. (Agency.) Amsterdam, Netherlands. *1303.

Recording instruments, gages and safety equipment. (Purchase and agency.) Calcutta, India. *1301.

Textile and clothing manufacturing machinery. (Agency.) Rawal Pindi. India. *1290.

Instruments, electrical including frequency measuring. (Purchase.) Bern, Switzerland. *1321.

Hardware and cutlery. (Agency.) Beirut, Syria. *1364.

Pneumatic construction tools, cement mixers, steam rollers, derricks, air compressors and hand tools. (Agency.) Port-de-France, Martinique. *1354.

Machinery for manufacturing plate and window glass. (Agency.) Brussels, Belgium. *1357.

Mining and refinery machinery for copper and gold. (Agency.) Milan, Italy. *1335.

Presses, electric or hydraulic, for baling tobacco. (Purchase.) Bahia, Brazil. *1326.

Sugar cane grinders and refiners; rice threshers. (Agency.) Managua, Nicaragua. *1332.

Woodworking machinery. (Agency.) Brussels, Belgium. *1357.

*Interested American firms and individuals may obtain the names and address of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office. Please refer to key number.

Motors AND OTHER MATTERS

Despite dog days, auto factories are busy . . . Brief shutdowns will be general . . . 1938 equipment buying will start earlier than usual . . . New Ford design rumors heard . . . Trailer industry centering in state

BURNHAM FINNEY
Detroit Editor

DETROIT—Industrial activities usually lag during August dog days, but southern Michigan is an exception. Automobile factories are busy cleaning up assemblies of current models and preparing their plants for 1937 production. It is the industry's intention to start fabricating parts as soon as possible so as to build up a formidable stock in advance of assembly needs. Heavy releases have been given to some parts suppliers for September. These backlogs will serve as comfortable cushions in case of labor trouble in the fall, a possibility of which all car makers are not unmindful.

While assembly lines are scheduled to be down from two weeks to two months, some not resuming until about October 1, machine departments in certain plants will hardly pause between model shifts. Four days will be the extent of Plymouth's shutdown this month before starting on 1937 cars. Plymouth's capacity for making parts is considerably less than its capacity for assembling cars and a sizable stock of engines is a necessity during busy

New Models Under Way Soon

It appears that every company will have its 1937 program under way by September 15 at the latest. For this achievement the industry can thank machine tool builders and other equipment people. Some car manufacturers haven't yet awakened to the fact that 1933 conditions no longer rule and that the machine tool trade is no longer in a position to turn somersaults to please them. In such cases equipment builders have been forced to "throw a scare" into car production executives by postponement of desired delivery dates. Next year the story will be different, say machine tool companies. They can't continue to turn their shops upside down for Detroit's benefit and let other customers twiddle their thumbs, waiting.

Motor car companies will start earlier than ever before to make equipment purchases for 1938 models. They realize that machine tool business from other sources is apt to expand during the coming year and they don't relish being caught in a jam. Expenditures in anticipation of 1938 will likely be as early as next January. Some purchases may be made before 1936 is ended.

Will Be Big Buyer

Among the foremost equipment buyers the coming year should be Chrysler. It has spent relatively little compared with General Motors and Ford and is enjoying the strongest financial position in its history. It is said to be contemplating enlarging the capacity of the Plymouth plant, the bottleneck of which are the various machining departments. Chrysler incidentally is drawing into its own ranks much stamping work heretofore done outside, now that it has large press shops at both its Dodge and Wyoming factories in Detroit.

Perhaps it is just as well that equipment orders momentarily are scarce, since machinery companies are busy meeting deliveries. No important buying programs are before the trade and none is expected before October or November. Die makers still are operating full, but the pressure is easing a bit. Many new dies have been completed and already are in use.

Studebaker will have the distinction of being the first motor company to announce its news lines. September 15 is the date. No radical changes from the present design seem probable. Packard will be later in introducing its new six than some observers had predicted. Most announcements will be bunched in late October and early November. The New York Show opens November 11. Fall shows around the country will be grouped so closely together, even overlapping in many cities, that a movement is afoot to spread the mout more next year.

A new car shortage in September and October is more than a threat. Some companies haven't been able to build enough cars ahead to tide dealers over the tooling period, so that the country will see numerous dealers' showroms without a single car in them for several weeks.

With the trend toward all-steel tops and total elimination of wood from automobiles, sheets with a maximum width of 77 inches will be utilized the coming year. Still larger sheets are being talked about for 1938; they probably will be 88 to 90 inches in width.

Stainless Steel Popular

Stainless steel will hold its own next year, being specified for a growing number of decorative parts, such as exterior trim and molding.

Few mechanical changes are planned for the new Ford V-eight. Stories persist to the effect that it will look somewhat like the Lincoln Zephyr. Cast alloy steel pistons, standard equipment on the Zephyr, will be specified 100 per cent by Ford, according to reliable reports. Ford is continuing to build a limited number of small V-eight motors at Rouge similar to those used in England and France.

With the entry of Pierce-Arrow, Federal Truck and Hayes Body into the house trailer manufacturing business, Detroit has suddenly become keenly conscious of this new industry. Southern Michigan is the center of production, although trailer makers are scattered around the country. That the big fellows in the automobile industry are watching closely the development of this newcomer is indicated by the fact that an official of a large car manufacturing company is traveling around the country in a coach trailer and shortly will report to the management his reactions to living on wheels. Trailer companies are operating day and night, but can't keep abreast of orders.

Independent car makers are reported ready to use the new high-solid, low-viscosity lacquer developed by Hudson. It is being applied to all Hudson and Terraplane cars, giving a finish said to be comparable with that of synthetic enamel.

PERSONALS

C. R. ELLICOTT has been appointed superintendent of the Cambria plant of the Bethlehem Steel Co., Johnstown, Pa.

R. H. DAISLEY has been appointed assistant general manager of Wilcox-Rich Corp., Detroit, automotive valve, piston ring and parts manufacturer.

J. E. DAVENPORT has been appointed assistant chief engineer of motive power, New York Central Railroad.

R. W. DAVIS has been appointed assistant manager of the electrical manufacturing department, Allis-Chalmers Mfg. Co., Milwaukee. He joined the company in 1908 as student apprentice.

WILLIAM F. B. HENDERSON, manufacturing executive, Briggs Mfg. Co., automobile bodies, has been put in charge of manufacturing the company's new plumbing and other household stamped products.

OTTO JABELMANN has been put in charge of the new bureau of research, Union Pacific Railroad, Omaha, Neb.

J. F. LEIGHTIZER has been appointed assistant superintendent and master mechanic of the Island Division, Canadian National Railroad, with headquarters at Charlottetown, P. E. I.

J. F. LINCOLN, president, Lincoln Electric Co., Cleveland, has returned from a business trip to Germany where he has been investigating a machine for manufacturing oxygen.

M. H. MAWHINNEY, consulting engineer and partner of the Salem Engineering Co., Salem, Ohio, has retired.

T. J. MCDERMOTT, chief draughtsman, has been appointed mechanical engineer of the Delaware, Lackawanna and Western Railroad, Scranton, Pa.

PHILIP J. NORTON has been appointed assistant general superintendent of motive power and machinery, Union Pacific Railroad, with headquarters at Pocatello, Idaho.

GEORGE E. SMITH has been named assistant general manager of the Reo Motor Car Co., Lansing, Mich., and FRANK D. LONGYEAR has been appointed production supervisor.

DELMAR G. ROOS, vice-president in charge of engineering, Studebaker Corp., South Bend, Ind., has resigned. One time chief engineer of Pierce-Arrow and later of Marmon Motor Car, Mr. Roos has been a president of the Society of Automotive Engineers, Inc.

J. T. SLAVIN, master mechanic, coast division, Southern Pacific Railroad, retired, has been succeeded by A. B. WILSON, master mechanic, Portland division, of the railroad.

Machinery Manufacturer Dies

NEAL R. TOWNLEY

President of Walcott Machine Co., and the Crankshaft Machine Co., Jackson, Mich., NEAL R. TOWNLEY, 41, died July 13, after a lingering illness. He had been connected with the Walcott company during his entire business career.

GEORGE SUMMERFIELD, formerly chief inspector of Olds Motor Works, Lansing, Mich., has been appointed chief inspector, Hill Diesel Engine Co., Lansing.

P. C. WITHROW, mechanical engineer, Denver & Rio Grande Western Railroad, has been appointed acting general mechanical superintendent of the line, Denver, succeeding W. J. O'NEILL, who has been named superintendent of motive power, Western Pacific Railroad.

MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Niagara Falls Meeting, Sept. 16-19, Niagara Falls, N. Y., C. E. Davies, secretary, 29 West 39th St., New York, N. Y.

AMERICAN WELDING SOCIETY, Oct. 19-22, Hotel Cleveland, Cleveland. Miss M. M. Kelley, secretary, 29 West 39th St., New York.

DAIRY & ICE CREAM MACHINERY MANUFACTURERS ASSOCIATION. Oct. 12-17, Atlantic City, N. J. Roberts Everett, vice-president, 232 Madison Ave., New York.

GREAT LAKES EXPOSITION, July, August and September, Cleveland, Lincoln G. Dickey, manager, Terminal Tower, Cleveland.

INTERNATIONAL ACETYLENE ASSOCIATION, 37th annual Convention, Nov. 18-20, St. Louis.

NATIONAL METAL SHOW. 18th Annual Exposition. Oct. 19-23, Lakeside Exposition Hall, Cleveland. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

NATIONAL SAFETY COUNCIL, INC. 25th Congress and Exposition, Oct. 5-9, Atlantic City, N. J.

SOCIETY OF AUTOMOTIVE ENGINEERS, INC., Aircraft Production Meeting Oct. 15, 16 and 17, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 West 39th St., New York.

OBITUARIES

JOHN CAMPBELL, 63, president of Campbell Foundry Co., Harrison, N. J., which he founded in 1923, died Aug. 10 at South Orange, N. J. Mr. Campbell, who was born in Scotland, joined the Maher & Flockhart Co., later the Flockhart Foundry Co., in 1892, becoming secretary of the company. For years he had been active as secretary of the old Newark Foundrymen's Association, and was a leading figure in the machinery and foundry industry. He was a director of McKiernan & Terry Corp., machinery manufacturers, New York.

FRANK LYMAN CONE, 67, president of Cone Automatic Machinery Co., Windsor, Vt., manufacturers of large automatic machinery used in the automotive industry, died Aug. 14 in his home. He was noted as an inventor of automatic lathes.

GEORGE G. FASSETT, 66, president, Fassett Boiler Works, Wellsville, Ohio, died Aug. 13.

N. A. HAWKINS, 69, who early in the beginning of the Ford Motor Car Co. history was general factory manager, died Aug. 18. He later became sales head of the concern.

STANLEY WINSLOW HEALD, 28, associated with his brothers in the management of Heald Machine Co., Worcester, Mass., died Aug. 14. A son of the late JAMES N. HEALD, he joined the concern upon graduating from Worcester Polytechnic Institute.

HUBBARD D. NITCHIE, SR., for nearly 40 years with the Watson-Stillman Co., Roselle, N. J., hydraulic machinery manufacturer, died August 2.

JOHN GILMORE PLATT, 62, president and general manager of Hunt-Spiller Manufacturing Corp., South Boston, Mass., metal parts manufacturer, died July 26.

HOWARD A. WARFEL, 47, president, York Tool Co., Yorktown, Ind., a founder of the concern, died recently.

American Machinist REFERENCE BOOK SHEET ©

Drop Forging Data

Courtesy J. H. Williams & Co.

A drop-forging is the basic cleaned, trimmed and sized metal article initially formed by placing and working hot metal in a plastic but solid state between reciprocating die impressions, forms or cavities in closed dies, either with or without subsequent dissimilar operations such as grinding or finishing to its ultimate state.

Forgings as small as 0.02 lb. are regularly made. While large quantity requirements most easily absorb the expense of special dies, sometimes a quantity as few as 50 pieces will justify the initial die expense.

Material used may be any desired carbon- or alloy-steel analysis, stainless steel, iron, tobin bronze, monel metal, aluminum, beryllium copper and other metals. In ordering forgings the steel must be specified by the S.A.E. number, by chemical analysis, or complete engineering data must be given on the application of parts and stresses. Machinability requirements should be specified and whether the forgings are to be delivered normalized or heat-treated, and to what hardness or physical properties. Requirements, if any, should be stated for grain flow or size.

The weight of a forging may be ascertained in advance by calculating its total volume in cubic inches through breaking down its structure into elementary geometric solids, and multiplying by the weight per cubic inch as given in the accompanying table.

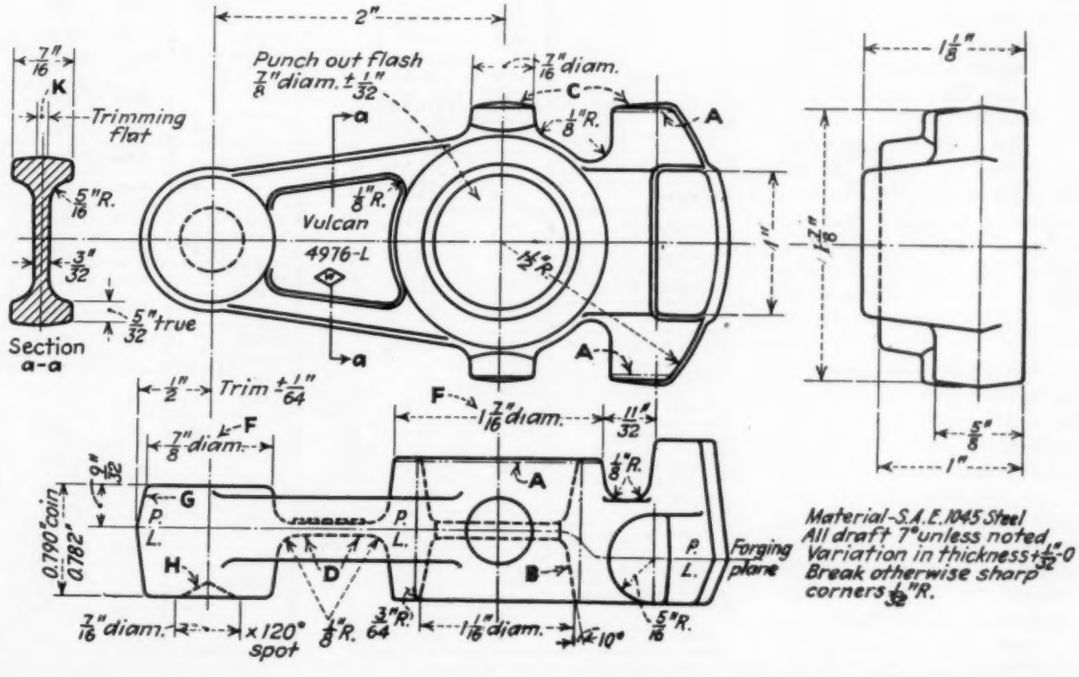
Lead casts are submitted to customers for approval after completion of dies and before making forgings. These casts are obtained by casting molten lead in the finished die impression. Since dies are 3/16-in. per ft. oversize to allow for hot steel shrinkage, any dimensions which are held locked by the impression while the lead freezes may measure 3/16 in. per ft. oversize.

With a lever such as shown, the designer decides on a parting line (PL) which establishes all the formation above the parting line as being sunk or formed in the face of one die block and the balance in the companion die block. The dies must not be hooked or interlocked with the piece in any way to prevent separating die from die or lifting the hot forging from either die. Intricate cores and undercuts as in sand and die casting are not feasible.

While many pieces can be sunk with flat faces because the PL is straight, in the case of the lever shown the PL must change from one level to another to part through the centers of the 7/16-in. diameter and the 5/16-in radius and to clear properly. This creates a locked die, meaning that the die faces which carry the impression are of irregular topography.

It is also necessary to decide on a forging plane, since some pieces can be cocked up in dies. The forging plane is an imaginary plane at right angles to the die reciprocation and is important as all clearance or draft must be measured therefrom. Frequently, pieces may be tipped in the die to produce natural draft at important points.

Drop forgings are subject to a variation in thickness dimensions (all dimension perpendicular to the forging plane) amounting to 0.015 in. on very small forgings to 3/16-in. on very large



Drop Forging Data

forgings. The variation on the average small forging is 1/32-in. which may be requested as + 1/32-in. — 0 or ± 1/64-in., or + 0 — 1/32-in. Lengths of forgings may vary as much as ± 0.003-in. per inch of length. Maximum permissible tolerances should be indicated wherever possible.

Surfaces of parts to be machined or ground should show or specify allowances for finish, usually 1/32 to 1/16 in. on a surface, but as little as 1/64-in. on very small pieces, and as much as 1/8-in. on very large forgings. If the surface also carries draft, the draft is considered additional thereto. Phantom lines are shown at the points marked *A* on the accompanying lever to indicate the machined surfaces.

To prevent seizing or sticking of the hot steel in the impressions as it deforms into the various recesses and tends to chill or shrink, it is necessary to allow draw or clearance, commonly known as draft, on all walls or surfaces perpendicular to the forging plane. The standard draft angle is 7 deg. around all exterior surfaces. Interior draft such as holes in the forgings, which form frustrums of cones in dies, as at *B*, should have 10 deg. draft. Lesser exterior draft, such as 3 and 5 deg., is frequently permissible, but always at some increased cost of forgings through more rapid failure of dies. See the table for "Die Draft Equivalents."

Ends of round sections are generally milled in the dies to create a spherical end crown known as "radial draft." Such 7 deg. draft is depicted on drawings by swinging a radius equalling twice the barrel diameter; that is, a 7/8-in. radius for 7/16-in. diameter barrel, but it is never dimensioned, however, as at *C*. The same applies to half rounds.

Fillets on forging drawing should be as large as possible as at *D*, to assist flow of hot metal and promote economical manufacture. Similarly projecting corners or edges should be nicely rounded since very sharp corners tend to propagate die checks or cracks and premature die failure. The usual broken corner on forgings is 1/32 to 1/16 in. radius.

Draft angles are subject to increase as the dies wear. For this reason it is best to show all dimensions to points deepest in the die as at *F*, and not over-all or to the parting line. If an over-all dimension is of vital importance, it should be emphasized by suitable notes. When the regular draft angles do not match the PL because of one die having a greater depth of draft than its mate, the draft in the shallow die is increased as at *G* to meet the deeper die.

Very narrow and deep depressions in the forgings itself are weak male protrusions in the dies, which do not stand up under heat and pressure of hot metal during forging. They must be moderated in depth and carry 10 deg. draft as a minimum and good fillets. The depth of a depression or forged hole in either half die should not exceed two-thirds of the least width of the depression.

Very thin ribs or webs on forgings should be avoided whenever possible, particularly on alloy steel forgings. Thicknesses of 3/32 to 1/8 in. or greater are preferable for best production and lowest cost.

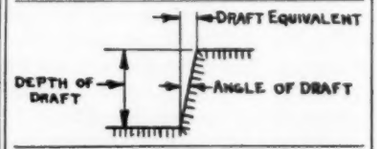
Accurately placed drill spots of 105 to 120 deg. included angle can be provided in the forging as at *H* on any surfaces approximately parallel to the forging plane to aid in drilling.

The forging operation produces a flash or surplus of thin waste all around the outline at the parting line, which is sheared or trimmed off close to the body by a hot or cold operation. A trimming flat as at *K* is left from 1/32 to 1/4 in. in width depending on the size of the piece and the newness of the die. Unavoidable variations in trimming may cause a very slight bulge of flash to remain. Whenever portions of the trimmed outline must be held very close, the drawing should so specify.

WEIGHTS OF METALS

NAME OF METAL	WEIGHT LBS. PER CUBIC INCH	RATIO OF WEIGHT TO WEIGHT OF CARB. STEEL
Aluminum	.098	34.6%
Aluminum Bronze	.271-.296	95.7-104.6%
Beryllium Copper	.298	105.3%
Brass (60-40)	.306	108.1%
Copper	.324	114.4%
Duralumin	.101	35.7%
Everdur	.305	107.7%
Forging Brass	.310	109.5%
Iron Cast	.260	91.4%
Iron Pure	.285	100.7%
Iron—Stainless	.280	99.0%
Lead	.410	144.8%
Monel Metal	.318	112.3%
Steel—Alloy	.283	100.0%
Steel—Carbon. .	.283	100.0%
Steel High Speed 18-22 Tung.	.320	113.1%
Steel High Speed 12-14 Tung.	.311	109.9%
Steel Stainless 13 Cr.	.280	99.0%
Steel Stainless 18-8	.285	100.7%

DIE DRAFT EQUIVALENTS



DEPTH	ANGLE OF DRAFT 5°	7°	10°
1/32"	.0027	.0038	.0055
1/16"	.0055	.0077	.0110
3/32"	.0082	.0115	.0165
1/8"	.0109	.0153	.0220
5/32"	.0137	.0192	.0276
3/16"	.0164	.0230	.0331
7/32"	.0192	.0269	.0386
1/4"	.0219	.0307	.0441
9/32"	.0246	.0345	.0496
5/16"	.0273	.0384	.0551
11/32"	.0301	.0422	.0606
3/8"	.0328	.0460	.0661
13/32"	.0355	.0499	.0716
7/16"	.0383	.0537	.0771
15/32"	.0410	.0576	.0827
1/2"	.0438	.0614	.0882
9/16"	.0492	.0691	.0992
5/8"	.0547	.0767	.1102
11/16"	.0601	.0844	.1212
3/4"	.0656	.0921	.1322
13/16"	.0711	.0998	.1433
7/8"	.0766	.1074	.1543
1"	.0875	.1228	.1763

Ideas FROM PRACTICAL MEN

Nonsensical Gaging

FRANK HARTLEY

There is an old saying that "too many cooks spoil the broth." Whether they be cooks or mechanics the principle still applies. They certainly had their fun with this one. The objective was to gage the length of thread *A* in the upper view of Fig. 1 to a length given as plus or minus 0.010 in., although the thread could have been $\frac{7}{8}$ in. plus or minus $\frac{1}{16}$ in.

The first man to tackle this job designed a gage as shown at *B*. This has a plain hole that slips over the outside of the thread with a step on the end equal to the limit specified. As this did not gage in the V of the thread, No. 2 man designed the gage shown at *C*, consisting of a flat piece of stock having two threads at the end which enter to the full depth of the thread. The object was to insure that the work was threaded within the minimum length.

The job then advanced along to luminary No. 3 who evolved the gage shown at *D*. This appeared to be quite ideal although rather slow in action as the gage must be screwed over the thread to see if the threading is within the limit shown.

However, as nothing is ever worthwhile unless it has passed the board of censors, No. 4 man decided that the gaging of this thread should be accomplished as shown at *E*. He took a standard thread gage indicated at *F* and screwed it on the thread as far as it would go. Then using a plate gage *G* having a "go" and "not go" limit, he proceeded to gage the work by trying first one end of the gage and then the other over the end of the work.

After all there is nothing like seeing how a thing actually works in practice. Referring to Fig. 2, the threaded part is shown at *A* with the ring gage *F* screwed up to the shoulder, but for some reason the thread does not come at right angles to the axis of the work and the gage has an angular appearance, as greatly magnified in the illustration. Therefore, the limit gage *G* cannot be used to get a correct reading. At this stage of the game someone with a practical mind decides that the rule of gaging everything need not apply in this instance, and that a scale measurement is sufficient.

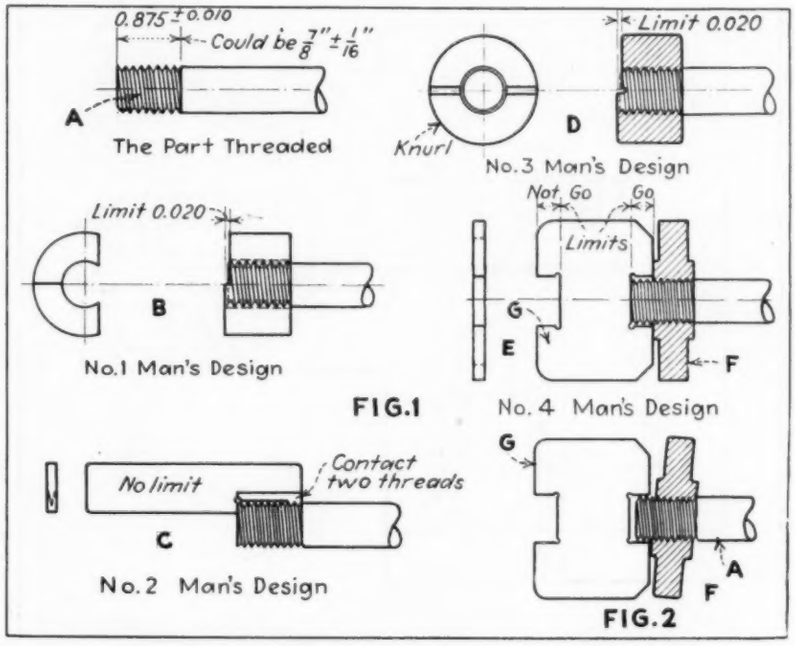


FIG.1 FIG.2

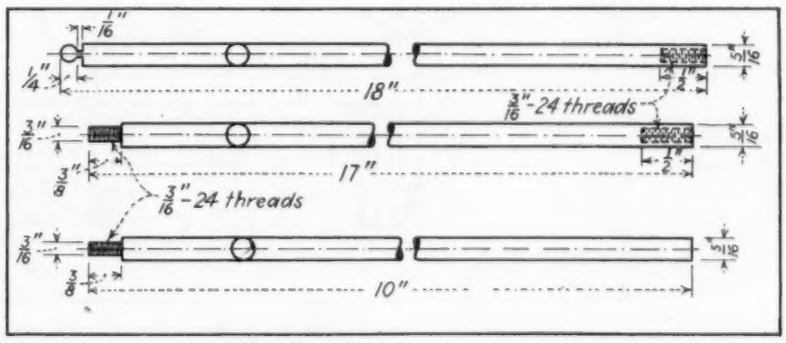
Fig. 1—Four men had four different solutions for this gaging problem. Fig. 2—The thread length was not very important and the threading was not very good, so we find that No. 4 man's gaging method works out thus

A Surface Gage Spindle

C. F. FITZ

Almost every mechanic who has run a boring mill or a planer has had jobs where a long spindle was necessary for the surface gage. Most of us use a long piece of $\frac{3}{8}$-in. drill rod which meets our needs very well, with the exception that it cannot be put into our tool boxes. The result is that somebody always uses it for making screw drivers.

To overcome this difficulty I made the surface gage spindle shown. It is made from $\frac{3}{8}$-in. drill rod and drilled, turned and threaded to give a spindle variation from 10 to 45 in. in length, which is sufficient for most needs. When through using it the device is unscrewed and put into a tool box.



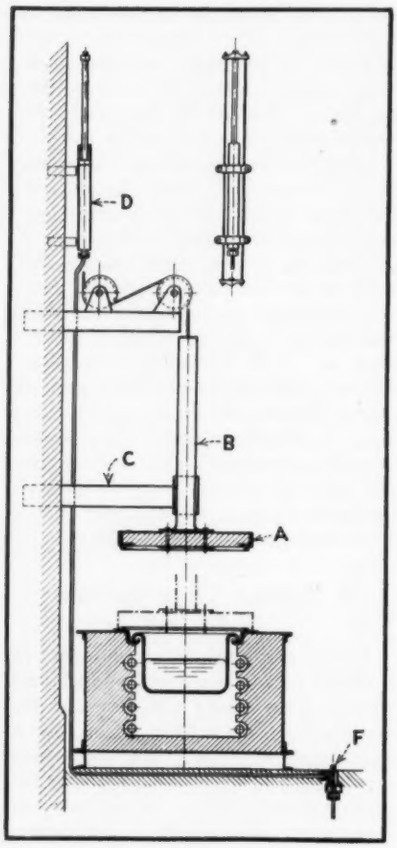
Lengths from 10 to 45 in. can be secured with these sections

Compressed Air Actuates Melting Pot Cover

ALBERT KOENIGER
Chief of Locomotive Shops, Alsace & Lorraine Railroads

A pull cover on our electrically heated babbitt pot was hard to operate and the workmen rarely used it. Considerable loss by oxidation was experienced, and to remedy matters a labor-saving device to operate the cover was devised. The new cover *A* is actuated by compressed air. A smooth tube *B* is fastened to the cover and is guided by the bracket *C*. A cable runs from the top of the tube to a yoke fitted to the piston of a small air-cylinder *D*.

When the workman wishes to ladle babbitt from the pot, he presses a pedal valve in the floor at *F*. Compressed air enters the cylinder and in pushing the piston up lifts the cover off the pot. The cover remains in the lifted position so long as the workman keeps his foot on the pedal.



When air is released from the cylinder the pot cover drops down and fits snugly over the flange

Non-Failing Pneumatic Clamping Device

A. C. GODDARD

For holding work to be face milled with a carbide-tipped cutter, it was considered necessary to design an air-operated clamping device that would not open should the air pressure drop during a cut. Since the development of this simple clamping device some 20 simple fixtures have been used with it.

The air cylinder, valve and clamping mechanism are mounted on two parallel plates *A*, which can be moved forward or back to suit conditions. This is done by loosening the nuts on the two bolts engaged in slots in the base. The bellcrank *B* connects the piston rod with the wrist plates *C*. These

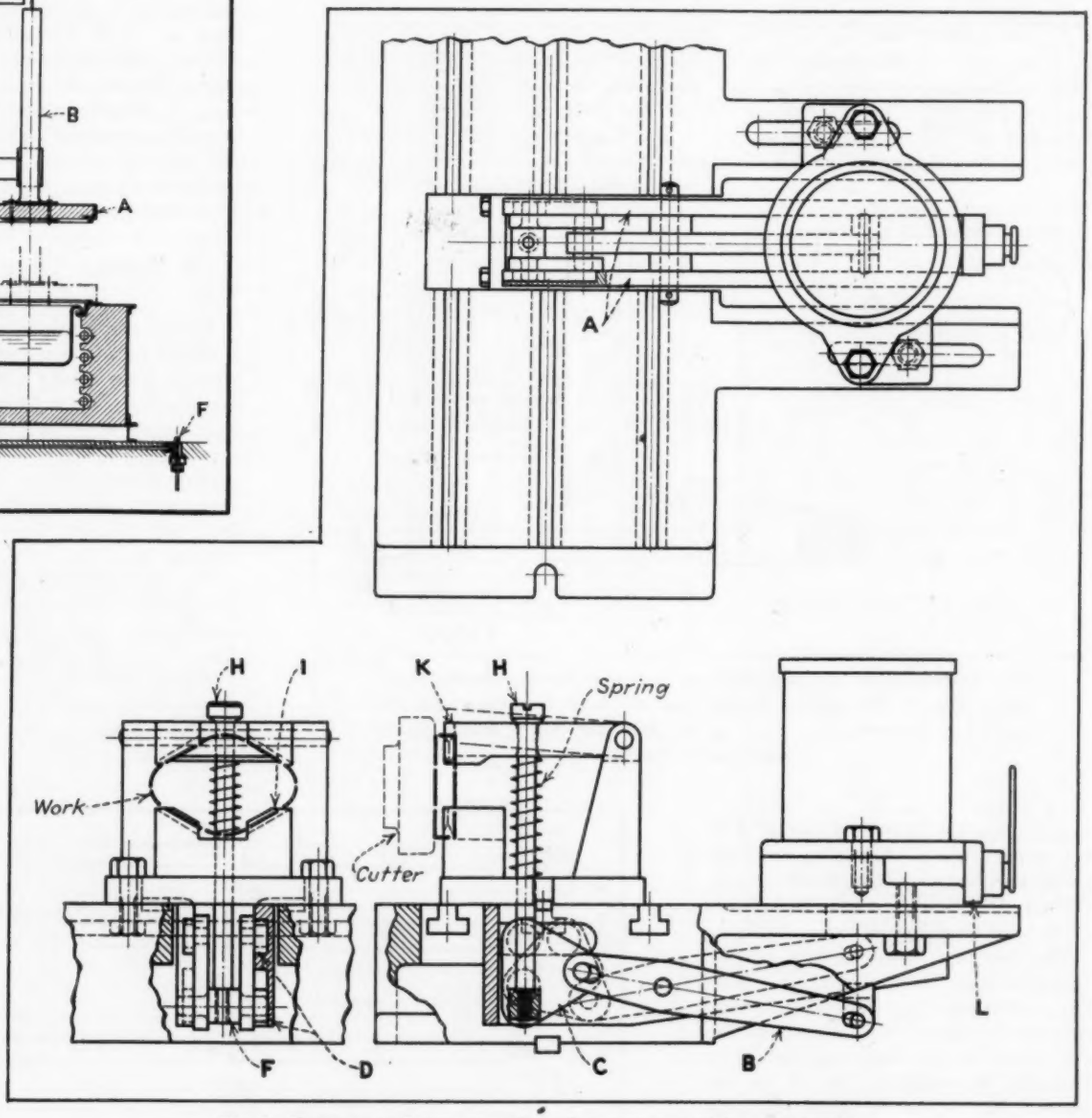


Fig. 1—Damage to the cutter and work are prevented by a wrist plate mechanism that cannot unlock should the air pressure fail

two triangular plates float on the four rollers *D*, two of which travel horizontally and the other two vertically in slots milled in plates *A*. Trunnion *F* serves as an axle for the rollers traveling in the vertical slots and is tapped for the drawbolt *H*. The holding fixture for the work consists of the stationary jaw *I* and hinged jaw *K* which is operated by the drawbolt.

In operation, the air valve *L* is opened to admit air above the piston. It then moves the piston-rod end of bellcrank *B* downward. As the opposite end of the bellcrank moves upward, the wrist plate is rotated counterclockwise, bringing down the drawbolt and clamping the work. The rollers in the horizontal slots are now over and in direct line with those in the vertical slots. In this position the mechanism is locked and the clamping jaw cannot become loosened should the air pressure drop.

In Fig. 2, details of the bellcrank and the wrist plate mechanism are shown at the top. The mechanism in the unclamped position of the work is shown in the center, and in the clamped position at the bottom. In this last view it will be seen that the wrist plate is locked and that the work will remain clamped independently of the air pressure in the cylinder.

Broaches of an Earlier Day

M. E. WHITE

Upon looking through an old tool chest, I chanced upon some broaches that were relics of another "periodic" depression. Out of work at the time and broke, I saw an advertisement for a die maker and fared forth to land work. It was a drop-die job, a line quite unfamiliar, and so I inquired if there wasn't some work which they would give a good toolmaker.

Several tool post wrenches were brought out and the question asked as to whether I could make broaches to do a better job. I decided I knew enough about the principles of good cutting tools to tackle the job, even though broaches were not then well-known.

All of the teeth on the unsatisfactory broaches were cut at an angle to give a shear cut, and with negative rake. These teeth also came together at the corners and were sharp from the back to the cutting edge. I decided my broaches would have the teeth at right angles to the tool body (no shear), the teeth would be undercut to give a sharp cutting edge, they would not come together at the corners, and they could have a good land.

I was busily cutting teeth when the superintendent happened by. He said, "Why aren't you giving those teeth some shear?" I countered by telling him that I knew he was familiar with drop-forge die-making and asked whether he had ever seen a good diemaker grind his cold-chisels at an angle to make them cut easier. He evidently thought it a good answer for he grinned and walked away.

The first broach was 9/16 in. at the small end and to the size for a ⅝-in. wrench at the large end. After the tool was carefully finished, hardened, polished and drawn to a medium straw, I removed the ram from the vertical press and turned a conical depression in the lower end so that it would draw the broach to the center and keep it in alignment. When the foreman could not find a wrench of the proper size, he entered the broach in a 9/16-in. wrench and put it under the ram. Despite such abusive treatment the broach produced better work than had been done previously by the other tools.

We continued by broaching several of the proper rough blanks and found that the cut per tooth was excessive. I then made a set of three which worked satisfactorily. These were 6¼ in. over-all with 5 in. devoted to teeth spaced ⅜ in. apart. The tooth gashes were cut at a right angle to the axial line, the undercut 5 deg. about 1/16 in. deep and ⅛ in. wide, leaving a ¼-in. land, which was just slightly relieved. The end of the first broach in each set was used as a punch to size the starting hole and to clear it of any flash.

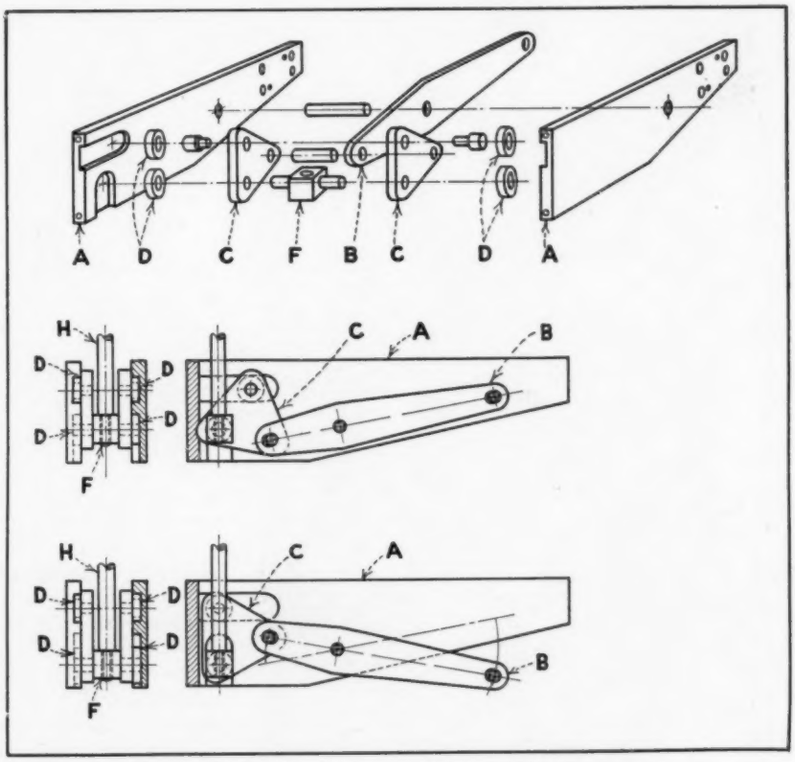


Fig. 2—Top, details of the wrist plate mechanism; center, position before the work is clamped; bottom, the wrist plate locked when the work is clamped

Lathe Fixture for Squaring Ends of Blocks

T. BONSALL
Redhill, Surrey, England

Reading the article by Peter L. Budwitz under the above title (*AM*—Vol. 80, page 385), leads one to the belief that the blocks were made in quantity. If so, and the illustration is a fair indication of the block lengths, it would seem that ingenuity has fallen short in not providing means for facing both ends simultaneously.

If the quantity is small and the blocks are to be faced on one end only at a time, a less expensive method would be to chuck them in a V-block held in a four-jawed chuck. Once the V-block was set to hold the blocks centrally, one jaw only need be used for loading and unloading and clamping and unclamping them. As most lathes have hollow spindles, the lengths of the blocks would not be a limiting factor, since their inner ends could project into the hole in the spindle.

Shop Equipment NEWS

Fellows Enveloping Gear Generator for Spur and Helical Gears

The Fellows Gear Shaper Company, Springfield, Vermont, has recently developed a machine and a type of tool for finishing spur and helical, internal and external, gears. The principle employed on this machine differs from the well-known gear shaper method in several respects: The tools used are made without any outside angle or side clearance to the teeth, and instead of being geared in harmony with the work, drive the latter. The enveloping generating tool is kept in intimate contact with the work at the same time that it is being rotated at high speed accompanied by a comparatively slow reciprocating movement.

The enveloping generating tool employed in this process embodies teeth that are conjugate to the teeth on the work, but so related that the teeth on the tool and work mesh only when the axes are placed askew to one another. The cutting edges on the tool intersect the faces of the teeth and extend in planes that are transverse to the axis. Thus, when the tool and work are brought into intimate contact and rotated under pressure, the divergent paths through which the teeth travel causes the cutting edges to move lengthwise and remove material by a shearing action. The surface of the teeth back of the cutting edges also contact the work under pressure, and effect a burnishing action, which produces a smooth surface on the contacting surfaces of the gear teeth.

This burnishing action is effected by making the sides of the teeth on the tool bowed, so that contact between tool and work takes place over substantially the entire length of the engaging surfaces. For an external gear, the teeth on the tool are bowed inward; whereas, for an internal gear, the teeth on the tool are bowed outward, because an internal gear is the reverse of an external gear. The cutting faces of the two members of the tool are slightly separated from each other. The width of this space and the degree of curvature, or amount of enveloping contact of the teeth, are important, as they govern the amount of material removed at each traverse cycle of the tool, as well as the resultant finish on the work.

The outstanding virtues of this process for finishing gears are: simplicity of design; ease of sharpening; and high production. The tool is simple in design, as it comprises only four members, two cutting and burnishing members, a spacing collar, and a holder upon which the members are retained.

Sharpening is easily accomplished, and the method of sharpening is governed by the degree of angularity necessary between the work and the tool. In some cases, the sharpening is done by face grinding, similar to a spur-gear shaper cutter; whereas, in other cases, the individual teeth are sharpened similar to a normal-sharpened, helical-gear shaper cutter.

Owing to the way in which the tool is applied to the work, it is possible to operate it at high rotative speeds without detriment to the tool either from the standpoint of cutting or burnishing. Speeds as high as 1,000 surface ft. per min. can be employed. An excellent finish results as the tool can be fed slowly back and forth across the gear to remove the necessary amount of material and to obtain the desired finish, and yet consume a comparatively short time in doing so. The teeth of the gear can be reduced in thickness approximately 0.002 in. per traverse cycle, and if the gear is roughed to commercial limits, one complete traverse cycle is, in most cases, sufficient. As an example of the high-production possibilities, an 8-pitch gear, 2 in. pitch diameter, 1 in. face width, can be finished to a high degree of accuracy in 25 sec.

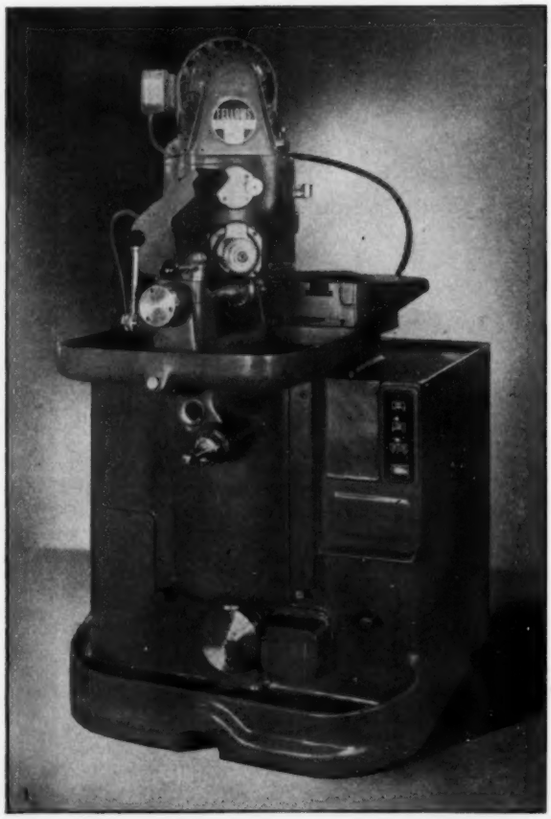
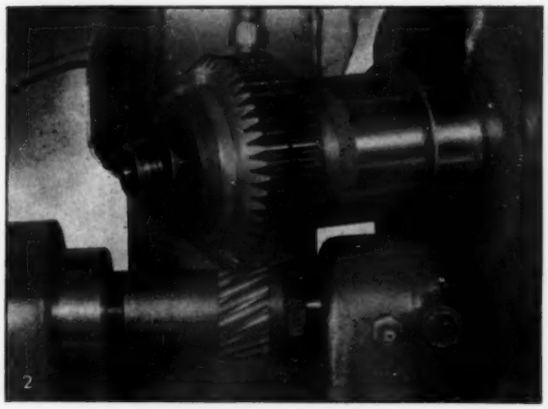


Fig. 1—No. 4 Fellows Enveloping Gear Generator for finishing spur and helical external and internal gears

The design of the enveloping generating tool is governed by the shape and character of the work. For instance, the tool used for generating a spur gear is made with helical teeth, so that the axes of the work and tool, when in operation, can be set askew to each other. On the other hand, the tool used for generating helical gears is made with spur teeth to provide for the necessary angular setting. This is clearly seen in Fig. 2. There are cases, however, where it is necessary to compromise, because of the nature of the work, and for a helical gear, the tool is made with helical teeth



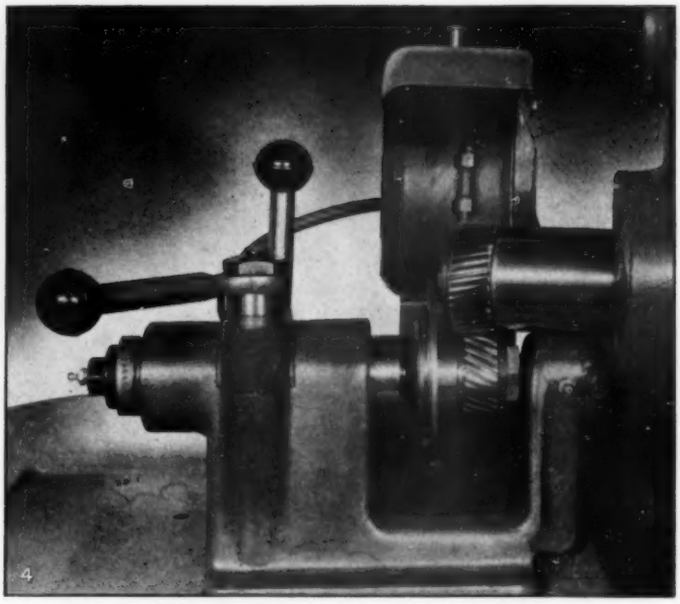
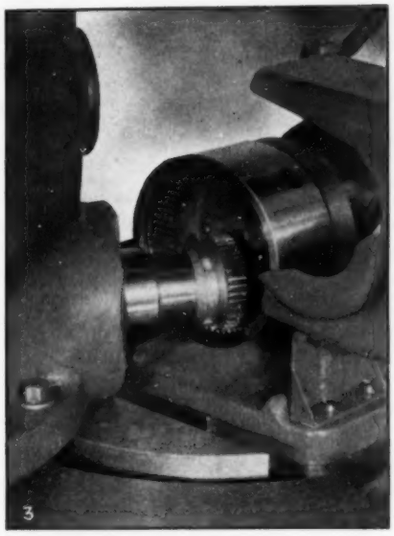


Fig. 2—Enveloping generating tool finishing a helical pinion. Fig. 3—Enveloping generating tool finishing an internal helical gear. Fig. 4—Enveloping generating tool used for finishing a helical shoulder gear

of a lesser angle than that on the gear it is intended to cut. The tool is then set at an angle with relation to the work, this angular setting making up the difference between angles on tool and work.

Figs. 2, 3, and 4 show applications of this type of tool to the generating of an external helical pinion, an internal helical gear, and a helical gear of the shoulder variety. This latter illustration shows a different type of enveloping generating tool, which is necessary, because of the fact that the tool cannot be reciprocated without interfering with the projecting shoulder. For work of this character, the enveloping generating tool is made in one piece and envelops the full face width of the gear. The cutting edges are obtained by providing the tool with a series of slots cut to the full depth of the teeth, and located in a helical path normal to the helix of the teeth on the tool. These slots are spaced fairly close together to present the maximum number of cutting edges. While the principle of cutting and burnishing is somewhat similar, this tool need not be reciprocated, although a slight amount of reciprocation is beneficial in that it reduces the pressure required. This type of tool is, of course, only employed where it is impossible, because of the nature of the work, to use the two section tool previously described.

A front view of the No. 4 enveloping gear generator is shown in Fig. 1 where it will be noticed that the work to be machined is retained in a fixture, the nature of which is governed by the character and shape of the work. Usually, the work is retained on ball bearing centers, permitting its free rotation by the enveloping generating tool. The work is elevated and lowered to bring it into and out of contact with the enveloping tool by a cam located at the front of the machine, and the enveloping generating tool-spindle is reciprocated by a crank motion. The machine is provided with complete electrical control and employs two motors. One motor rotates the enveloping generating tool-spindle through change gearing, and the other operates the crank mechanism and elevating cam. Arrangements are provided for securing the desired number of reciprocating cycles through change gears. The elevating cam can be employed to produce a crowning effect on the gear teeth, which is sometimes desirable where shaft misalignment in the assembled unit must be provided for. The cam is made so that it elevates the work at both ends of the stroke, providing a crowning effect.



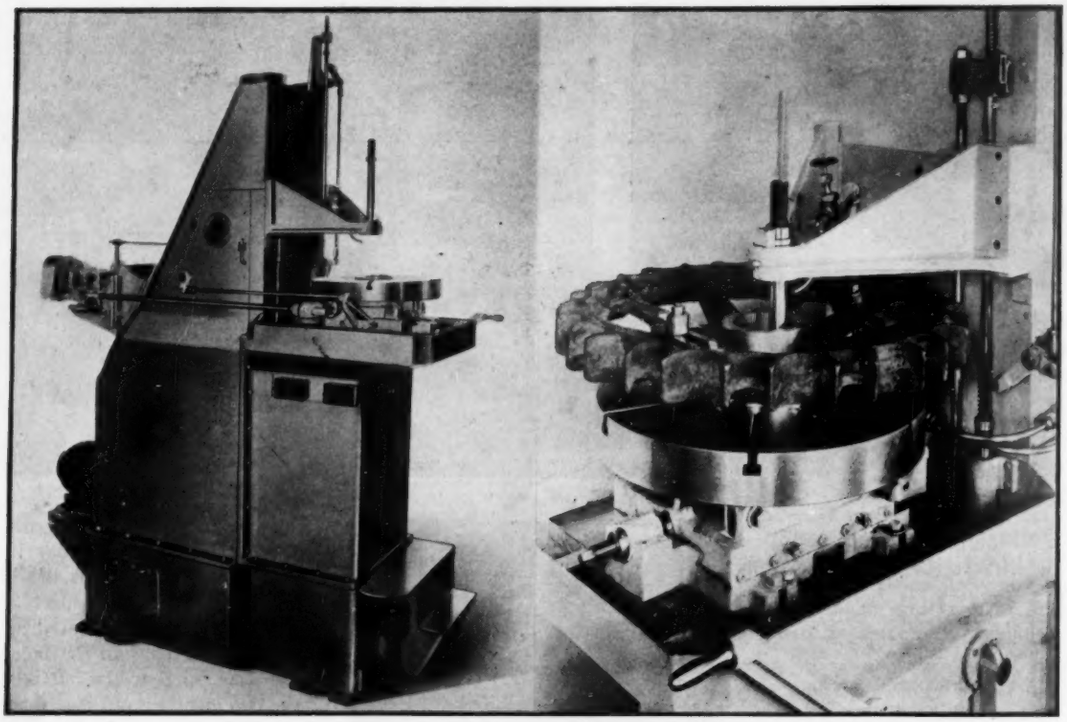
The slide is reciprocated an amount slightly greater than the face width of the gear, so that the cutting edges of the two members of the tool are brought out of contact with the work at each end of the stroke. The depth feed is accomplished at both ends of the stroke. The direction of rotation of the tool spindle is also reversed at each end of the stroke. This procedure applies only to the two section type of tool. Where the single unit tool, illustrated in Fig. 4, is employed, the tool is only reciprocated a slight amount, about 1/16 in.

This machine is made in two sizes, one designated as No. 4 having a maximum capacity for gears up to 5 in. pitch diameter, 1¾ in. face width, 7 D.P., and a maximum helix angle of 45 deg.; the other designated as No. 8 having a maximum capacity up to 8 in. pitch diameter, 2½ in. face width, 4 D.P., and a maximum helix angle of 45 deg.

Norma-Hoffmann Bearings Packed in Stable Grease

Wholly inclosed, sealed, precision bearings manufactured by the Norma-Hoffmann Bearings Corporation, Stamford, Conn., are now packed with a grease pre-tested for maximum stability. As a further precaution to provide against the effects of grease oxidation, the bearings are wrapped in aluminum foil. These measures safeguard the bearings against oxidation and premature hardening of grease.

La Pointe Automatic Broaching Machine With Indexing Mechanism



Left—After the work is loaded into the La Pointe automatic broaching machine, the broach guide is moved downward into place and supported at both ends, and the broach travels up and down in this guide. Right—Close-up of work and broach in place in its guide. Adjustment for depth of cut is made by an accurate screw

Eighty involute splines are broached in the hub of a cast-steel tractor drive gear by an automatic broaching machine developed by the La Pointe Machine Tool Co., Hudson, Mass. The work is 37½ in. in diameter and weighs approximately 400 lb. The length of cut in the hub is 6 in., and the taper of the hole is ¾-in. per ft. Sixteen minutes is required for broaching the eighty splines, and the depth of them is uniform for the entire length of the hole.

This machine is equipped with an automatic indexing mechanism consisting of rotary work table and slide, and an indexing change gear box driven by an electric motor. The gearbox has pick-off gears for a number of indexes within its range.

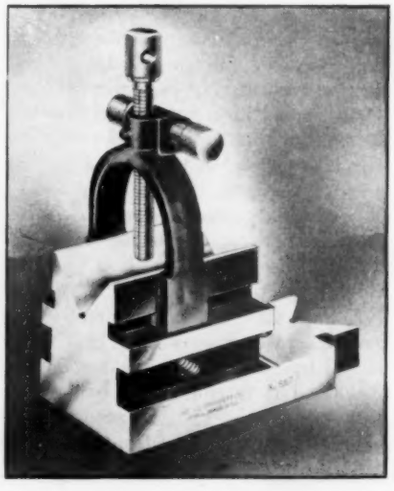
The work table is arranged for tipping up to any desired degree, is 30 in. in diameter and has two slots for clamping the work. At the end of the cut the work is woved away from the broach by means of a hydraulic cylinder connected to a slide. At the same time the indexing mechanism is tripped and indexing takes place during the return of the broach. Les sthan 1 sec. is required for indexing. At the end of the upward stroke, the work is again moved into the broach against a fixed stop and the broach is again pulled downward and the operation repeated. After the operator starts the machine all operations are fully automatic until completed.

Starrett No. 567 V-Block and Clamp

A V-block and clamp with several features that broaden its use for both production and inspection work has been added to the line manufactured by the L. S. Starrett Co., Athol, Mass. The block is made of steel, hardened and ground. The sides are ground parallel and the V grooves are ground central and parallel to the sides and base.

A forged clamp, which holds cylindrical stock in the V grooves, has an adjustable support to keep the block from tilting while it rests on its side. One end of the block is stepped down. It has a V-groove and slots at right angles to the base in which the clamp can hold shoulder studs and round pins for light milling, drilling and grinding. Hole clearance is provided for drilling and removing dowel pins. Four ⅜-16 tapped holes, two in the base and one on each side, permit securing the block to a faceplate or angle iron.

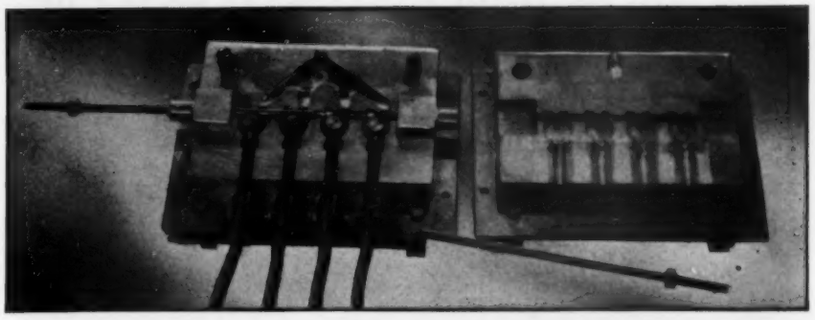
The block is commercially accurate and makes a support for duplicate cylindrical parts being inspected with a dial indicator. It is approximately 1⅞ in. square with a base length of about 3⅝ in. and a capacity of 1 5/16 in.



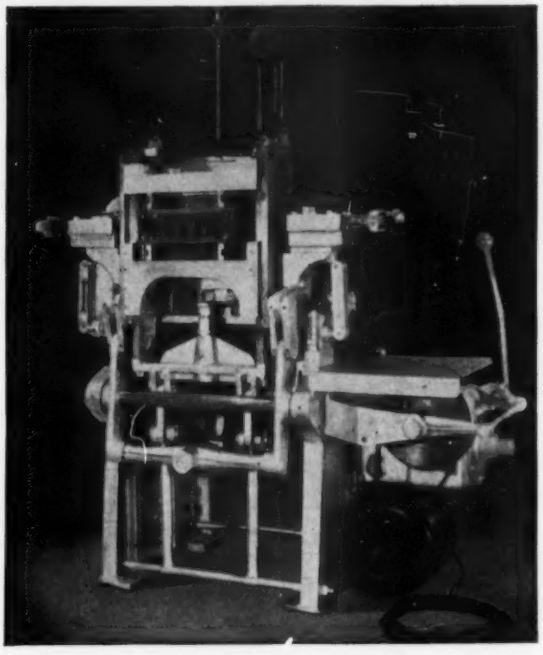
Kux-Lohner Model B-3 Die-Casting Machine

A vertical die-casting machine with a split sprue fill has been developed by the Kux-Lohner Machine Co., 2145-47 Lexington St., Chicago, Ill. This machine is particularly adapted to parts requiring long inserts; that is, casting lead battery terminals on the ends of insulated battery cables, and golf heads on steel golf shanks.

The Model B-3 has a plunger pressure up to 1,500 lb. per sq.in. supplied by means of a long helical compression spring. Die space is 14 in. between the bars by 12 in. wide. Die thickness, both halves, can be up to 7½ in. Die is separated by 5½ in. Volume of metal per shot including the gate is 5½ lb. in lead-base alloy or 3¾ lb. in zinc-base alloy. Cores can be pulled automatically from three sides of the die. Adjustable ejector mechanisms can be mounted in the upper and lower die-holder members. Machine is also fitted for the general run of die-cast parts in either single- or multiple-cavity dies that come within the range of the indicated die space dimensions.



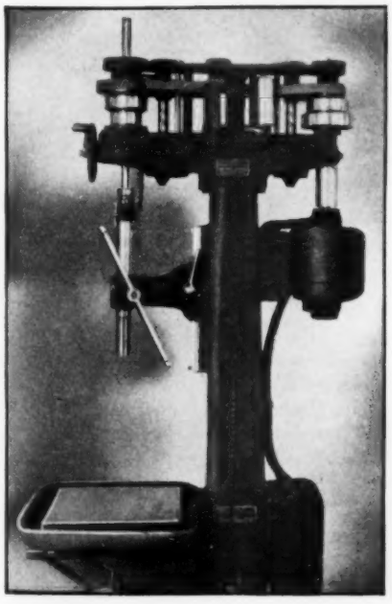
Four-cavity dies for casting terminals on battery cables



Ten shots per minute is the speed of the Klux-Lohner Model B-3 die-casting machine

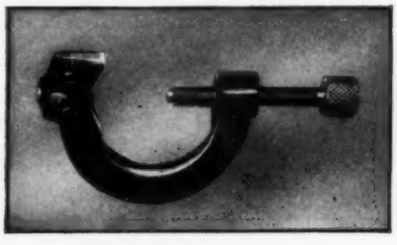
Motor Drive on Foote-Burt Drill

The Foote-Burt Co., Cleveland, Ohio, has added a new type of motor drive on its Sipp sensitive drilling machines. This drive has been especially developed for the medium size or BK Style machine having a capacity of ⅝ in. in cast iron. The drive consists of a standard, foot-mounted, ball-bearing motor which is mounted on a bracket at the rear of the column. The motor armature shaft is connected to the rear cone pulley drive shaft by means of a flexible coupling to make a short, compact drive. The three spindle speeds of 1,035, 1,725 and 2,915 r.p.m. can be obtained by shifting the speed lever at the front.



Dumore No. 10 Diamond Dresser

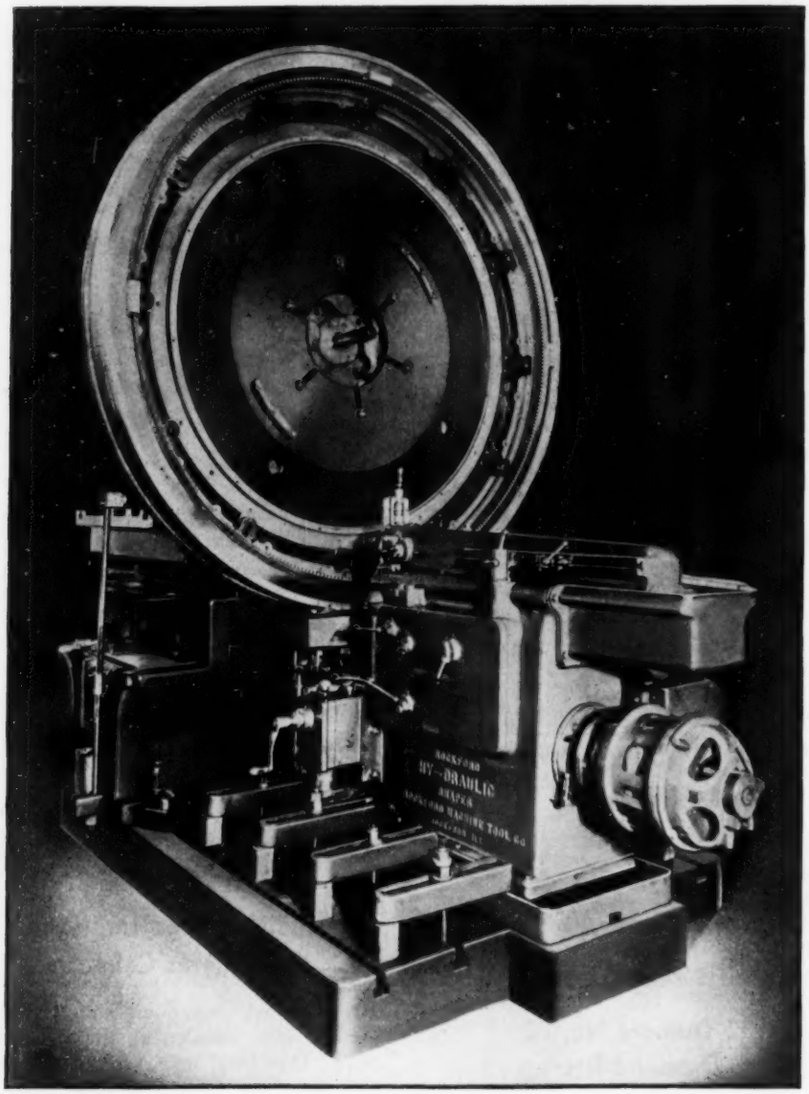
Poor cutting, loaded, and out-of-round wheels used on Dumore lathe grinders can be trued quickly with the grinding wheel dresser developed for the purpose by the Dumore Co., Racine, Wis. The dresser is clamped to a plug held in the faceplate and the grinder swung so that the wheel will contact the diamond of the dresser. The sides of the wheel as well as the face can be dressed to any surface.



"Swedish" Gage Improved Micrometer Caliper

A hardened, ground and lapped leadscrew is now supplied by the Swedish Gage Company of America, 7310 Woodward Ave., Detroit, in its micrometer calipers. Advantages are: (1) The leadscrew is hardened throughout its entire length so that the threads resist wear; (2) the threads are ground after hardening to eliminate loss of accuracy from distortion in hardening, and (3) the threads are lapped after grinding to rectify slight errors in pitch diameter and lead which are present in the ground thread and to improve the wearing qualities. These features aid high-production work.

Rockford Hy-Draulic Shaper Set-up to Cut Large Internal Gear



An unusual application of a standard Hy-Draulic shaper, manufactured by Rockford Machine Tool Co., Rockford, Ill., was devised to machine large circular work pieces which contain internal gears with 90-in. pitch circle, 2-in. face and 4-pitch teeth. The gear teeth were cut from the solid in tough steel in three stages; gashing, forming and finishing. Specifications required that the tooth form was not to be lapped or otherwise finished after machining and that no marks of any kind should appear on the finished surfaces. The relatively small quantity of these pieces machined at one time did not justify the purchase of a special gear cutting machine.

The work piece was mounted on the arbor of a highly accurate indexing device. The indexing head and the hydraulic shaper were mounted in accurate relationship on a heavy base. The shaper was selected for its smooth ram-drive which contains no gears or other mechanical developments which mark the machined surfaces. The high return-ratio, the quick shockless reversals and the uniform cutting speed throughout the stroke of the shaper ram were factors which combined to increase production on this job. The length of stroke in the Hy-Draulic shaper was established quickly by manual adjustment of two dogs; its accuracy and exact control were shown when the cutting tool ran out into a narrow groove at the forward end of the shaper stroke. No special preparation aside from accurate mounting was required for this unusual shaper application.

Reed-Prentice Lathes With Standard Spindle Nose

A standard lathe spindle nose for the 14- and 16-in. Model AA sliding gear head engine and Model B toolroom lathes has been announced by the Reed-Prentice Corporation, Worcester, Mass. This nose permits more ready and accurate placement of chucks and faceplates. Construction includes a long hardened taper bearing for alignment and a safety key for holding. The key permits plates or chucks to be hung on the spindle, thus allowing the operator to use both hands to start and tighten the collar. The key also brings the thread in the collar into immediate alignment with that on the faceplate or chuck. To take off or put on a faceplate or chuck requires but 12 to 15 sec. The following features are secured through the use of the standard lathe spindle nose: greater accuracy and longer life; low chuck inventory through interchangeability; labor saving through simple mounting; utmost safety; easy to clean, and less overhang.

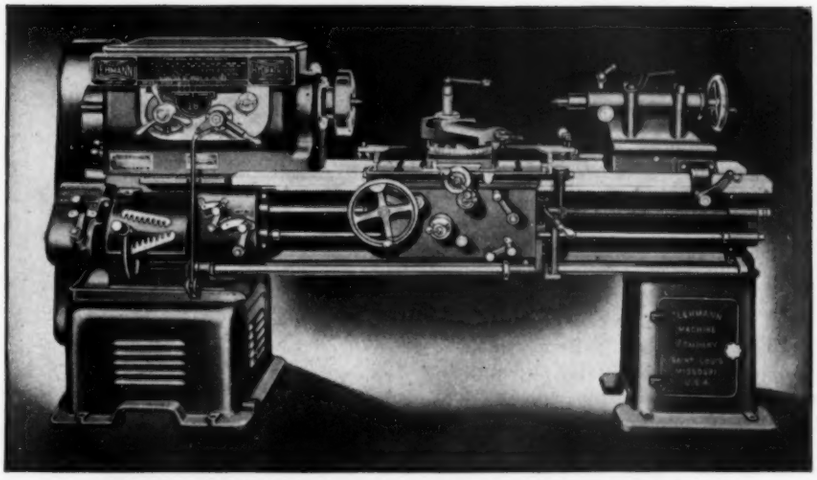
Beryllium Castings

Beryllium Corporation of Pennsylvania, Reading, Pa., is now in a position to supply heat-treated beryllium castings conbining high strength and high electrical conductivity. These castings are of a heat-treatable copper-base alloy having the following properties: electrical conductivity, 50 per cent of copper, tensile strength, 95,000 lb. per sq. in.; elastic limit, 85,000 lb. per sq. in.; elongation in 2 in., 5 to 8 per cent; hardness, 96-98 Rockwell B.

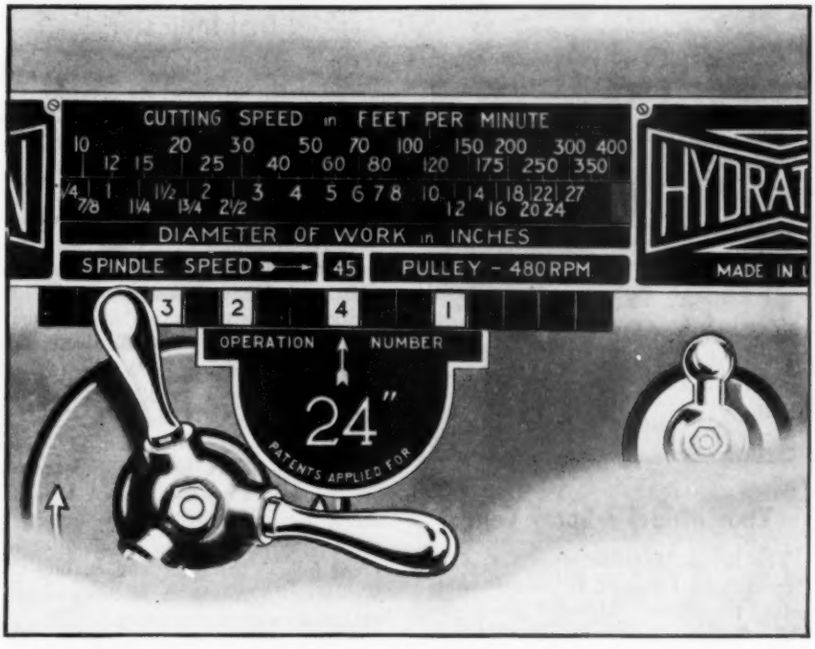
Operation Number Index for Hydratrol Lathe

The Lehmann Machine Co., Chouteau & Grand Blvd., St. Louis, Mo., has announced an improvement in Hydratrol lathes which involves the addition of an operation number index on the headstock. This lathe has 16 spindle speed changes, automatically effected through hydraulic medium by the operation of a three-lever handle on the headstock. These speed changes are made at the will of the operator while the lathe is running or stopped. Coordinating with the operation of the speed changing valve, the slide rule functions, presenting the cutting speeds in feet per minute for any diameter of work within the capacity of the lathe and also the spindle speed at which the machine is operating. This particular feature is shown in the close-up of the slide rule and index number panels.

The latest improvement, the operation number index, has sixteen panels for the reception of numbered tags or inscription of numbers or symbols for work operation. It is a matter of a few minutes for a time-study man, foreman, or operator to set the valve for the desired speed for each operation and attach the number tag or mark the panel with the number or symbol for as many operations as are required. The operator then can set the numbers or symbols to the central indicator, and automatically the machine changes to the spindle speeds which have been predetermined.



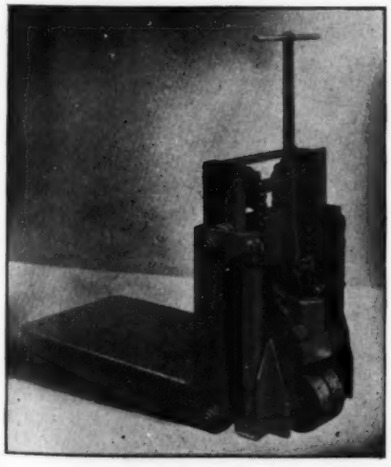
Hydratrol Hydraulic Lathe fitted with operation number index in addition to the slide rule feature for cutting speeds


CUTTING SPEED in FEET PER MINUTE
10 20 30 50 70 100 150 200 300 400
12 15 25 40 60 80 120 175 250 350
1/4 1 1½ 2 3 4 5 6 7 8 10 14 18 22 27
7/8 1¼ 1¾ 2½ 12 16 20 24
DIAMETER OF WORK in INCHES
SPINDLE SPEED
45
PULLEY - 480 RPM
HYDRAT
MADE IN
3 2 4 1
OPERATION NUMBER
24"
PATENTS APPLIED FOR

Sixteen spaces just above the operation number arrow take tags for each operation, and above this operation number index is the slide rule

Yale & Towne XB Lift Truck

The XB multi-stroke hand-lift truck, manufactured by Yale & Towne Mfg. Co., Philadelphia, has a lift of 10-in. and a capacity of 8,000 lb. It is equipped with chain lift and the load may be elevated by one operation to full height. Twenty-two forward strokes of the handle elevate the load. It is built with a sturdy covered deck which raises on rollers in the channel uprights. Two heavy-duty hydraulic release checks lower the load without a jar. Twin front wheels and full side lift make this truck easy to maneuver even in close quarters.



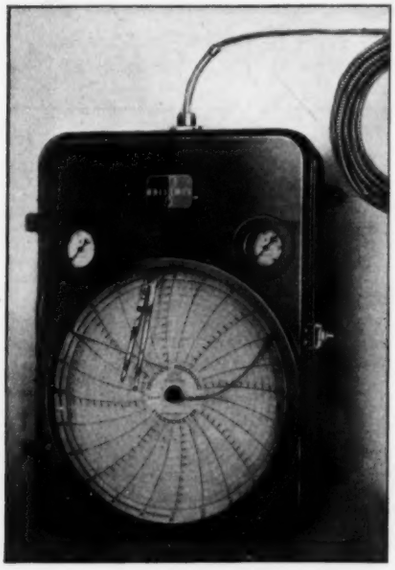
Hackett K-Copper

Hackett K-Copper, sold by the Hackett Brass Foundry, Detroit, combines the physical properties of steel and bronze with the high electrical and heat conductivity of copper. It has equal corrosion resistance, the same coefficients of expansion and resistivity and modulus of elasticity as copper and a hardness of 70 to 80 Rockwell B, 125 to 150 Brinell. Its ultimate strength is 70,000 lb. per sq. in., elongation is approximately 20 per cent, reduction in area 50 per cent, in drawn rod 83 per cent in electrical conductivity of pure drawn copper. In forged form it is 75 to 85 per cent that of forged copper.

The alloy is available in bars, forgings and castings, and is being widely used for welding tips and holders.

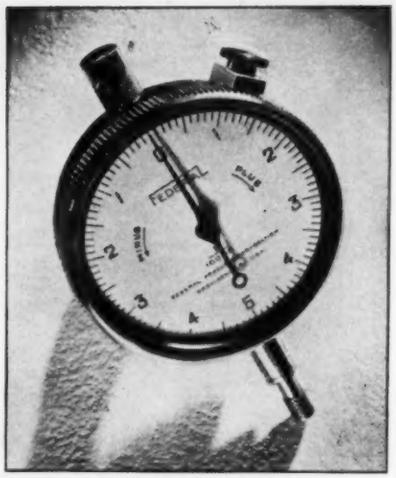
Bristol Master Free-Vane Controllers

For applications where a greatly reduced sensitivity (wide throttling range) is required, and the load conditions fluctuate over a wide range, the Bristol Co., Waterbury, Conn., is offering a line of Master free-vane controllers for temperature, time-temperature, flow, liquid level, pressure, time-pressure and humidity. These controllers are of the pneumatic type and embody the basic free-vane system which is equipped with a sensitivity adjustment, an automatic reset, and accessory features which minimize hunting.



Thor Model 7 Spray Gun

The Binks Manufacturing Co., 3114 Carroll Ave., Chicago, Ill., is now marketing the "Thor" Model 7 spray gun which is claimed to have greater speed, less air consumption and better atomization. The gun body is a drop-forged aluminum with black electrolytic coating for surface protection.



Federal Full-Jeweled Dial Indicator

A line of full-jeweled low-friction dial indicators for shops where precision requirements are exceptionally fine, has been developed by Federal Products Corp., Providence, R. I. By reducing the internal frictional resistance to a minimum, these indicators are exceptionally accurate in telling the true measurements of the work under inspection. They follow the work directly because the action is extremely light and free. The indicator point follows the surface variations in and out, precisely and quickly.

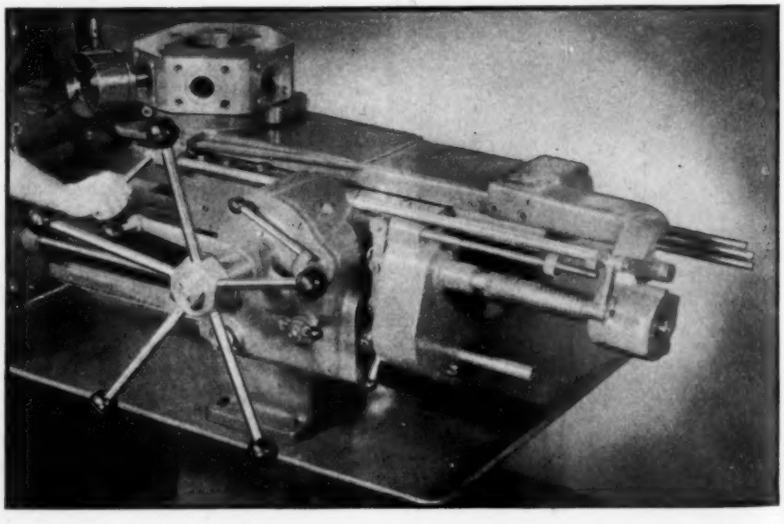
Out of roundness and other irregulations are quickly detected. There is less needle flicker because the indicator point does not bounce. A hexagon shaft, for example, can be inspected more quickly because the indicator point follows the piece and enables the inspector to rotate it faster and still obtain an accurate reading.

Thread Chasing Attachment for Gisholt Turret Lathes

For cutting smooth and accurate threads having a full bearing on every thread, the Gisholt Machine Co., 1245 E. Washington Ave., Madison, Wis., has developed a thread chasing attachment for the Nos. 3, 4 and 5 ram-type universal turret lathes. This attachment is designed for cutting with die heads or taps. It produces threads with perfect lead such as required in a threaded joint or coupling, long threads where accumulated error is not permissible and fine threads. Another field of use is in threading of stainless steel and copper which have a tendency to tear or gall and in the threading of soft metals such as aluminum or die castings.

The turret threading attachment leads the die onto the work at a uniform rate governed by a section of leadscrew. This results in the thread being free from drag of the turret and ram. Classified as a leader and follower, this threading attachment consists of a bracket for carrying the follower, a means of mounting and driving the leader, and suitable means for starting and stopping the threading feed. The leaders may also be used with the universal carriage thread chasing attachment and are available with either standard milled threads or special ground threads. The accuracy of the trip combines an ability to thread closely to shoulders with the positive thread cutting feed.

By using a selective gear box coupled to the feed shaft, one leader will cut three threads having one, two and four times the pitch of the leader. Threading capacity is from 4 to 32 threads. The gear box also makes available three ranges of feed, 24 in all, ranging from 0.001 to 0.104 in.



The Round Table

VARIETY

"I see you've bought another Jones drill, Al. Does the salesman have something on you?"

"I think it's a good machine, Ed. The one we have has worked out well."

"But is it any better than the Brown or the Smith?"

"Don't know Ed. I haven't used any of the new Browns, or Smiths either for that matter."

"Well, why not try one for a change? You might like it better."

"I looked them over pretty carefully, Ed, and I can't see that they have any features that are better than the Jones. So I bought another like the last."

"I'd try another make just to have variety in the shop. Why get into a rut?"

"Ruts, are funny animals, Ed. No two people seem to think of them in the same way. Conservatives say that its better to keep on in the ways that have worked out well in the past. Radicals, or liberals, call that sticking in a rut and want to do something else."

"That's sort of funny too, Al. You're generally the one I'd call radical. That's why I'd think you'd make a change."

"I'd be glad to, Ed, if I could see any advantage in it. But I don't see the sense of getting another make just for the sake of making a change."

"Shows more progress, I think."

"I don't get that, Ed. There is a real advantage in having duplicate machines. It saves money to have tools and fixtures that can go on several machines."

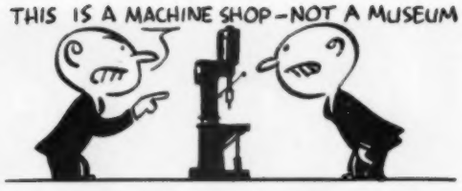
"But different machines might have points that made them better on different jobs."

"There's advantage in standardizing on one make of machine of a certain type. Some shops won't do anything else, especially when they carry a supply of parts."

"I still believe you'll get more for your money if each builder is on his toes for the next order."

"And I'm sure there's a lot more advantage in uniformity. The men who work on the machines make fewer mistakes. There's less expense in maintenance; the shop looks better. And why won't the maker of the machine you use be on his toes to keep you for a customer?"

"It doesn't look as though we'd ever agree on that, Al. I'm all for variety."



Is it advisable to standardize on one make of machine? Or is there something to Ed's argument on the virtue of variety?

DISCUSSION

Going to Townsend

In practice, the Townsend plan would not work because the 2 per cent tax on sales would increase the price of all articles. This would reduce sales and employment. It would also reduce the income required for the Townsend plan, due to the fewer sales. This plan is a tax on money in circulation. Obviously, if the money in circulation remains the same, it would buy approximately 2 per cent less when the tax was deducted. This 2 per cent reduction in goods purchased would considerably reduce employment and therefore prosperity.

Industry could not stand a price increase of 2 per cent. It would increase the cost of production of every article and the total price increase would in many cases greatly exceed 2 per cent, owing to the many purchased parts built into one machine.

Any pension scheme that relies for its income on a tax on money in circulation cannot fail to reduce prosperity. It may be argued that the purchasing power of those drawing pensions would be increased and would compensate for any reduction in demand. This would give some relief, but it would not be great enough to compensate for the reduction in demand, due to the price increase.

—W. E. Warner,
Orpington, Kent, England.

The Townsend pipe dream hasn't a Chinaman's chance of lasting over a few months at the longest. Then everybody would be broke or the $200 a month would possibly buy a three-cent postage stamp.

Prosperity has been the "ugly duckling" of the present administration and of the wild-eyed Piutes who have been manhandling all attempts of business to get back to normal. So long as an emergency can be created, politicians will continue to distribute largess that must be financed by future generations.

The Security Bill is not practicable. In its final analysis it is almost an at-

tenuated Townsend pipe dream. It is a compulsary thrift plan with somebody else furnishing the dough.

When to Weld?

Before purchasing a larger flame-cutting outfit, Al would do well to consider one of the modern bandsawing machines, together with its attachments for internal sawing, continuous filing and band polishing.

From one point of view, flame cutting is essentially a roughing operation especially adapted to large and heavy work where it is easier to move the cutting torch than to move the work. By way of contrast, Al's machine parts are mostly of such size and weight that they can be moved to the machine and there not only sawed out, but filed and polished where necessary. In addition, sawing makes a narrower kerf than does flame cutting and is applicable to a greater variety of materials up to 8 in. and over in thickness and ranging from plastics to alloy steels.

Al already has a small flame-cutting outfit and the addition of a suitable bandsawing machine appears to be a better investment than another and larger flame-cutting outfit.

—S. D. Bryden, Jr.

The increasing application of flame-cut and welded plates has in many cases reduced costs and speeded up deliveries. The method is so broad in application that there is hardly a limit as to what can be done. It is especially convenient where but one or a few pieces are required and the time of delivery is short. Very often the cost of large structures will be less than that of the patterns required for castings. Errors in welding can be corrected with but little delay by burning out the defective sections and welding in new ones, or by welding in ribs and braces to increase strength.

Welding spherical sections and complicated housings should be avoided if possible, as they employ a large number of pieces, some of which may require much forming and welding. Hollow columns, closed box designs and frames adapt themselves very readily to flame cutting and welding.

Cracking in flame-cut and welded plates is rare. Warping may at times cause some trouble, but it can be corrected and in many cases it can be controlled within permissible limits.

With a little judgment in the application of flame cutting and welding, Al will no doubt be able to show appreciable savings in time and money by the use of machines for that purpose.

—Karl Eck.

Concessions for Kickers

Repeat orders are valuable advertisements for the seller, as they show that the equipment originally supplied has given satisfaction. However, if such orders are obtained by giving special discounts, their value as advertisements is considerably decreased. For some classes of equipment, frequent replacement is necessary, therefore repeat orders are much more frequent than are original orders. If special discounts were given on repeat orders, they would show little profit, and the seller would get little benefit by satisfying his customers.

Favoring good customers in the way Al suggests would not be practical. All concerns have some troublesome customers, but the way to treat them is to give them just the equipment and service agreed upon when sales

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are made. Points are sometimes stretched in favor of good customers, even if the service they require is much greater than that originally agreed upon.

Many customers kick because they think it pays and that they get much better prices thereby. By making no concessions to such customers, they will soon stop kicking. If, by kicking, they get concessions, they will develop into chronic kickers.

—W. E. Warner,
Orpington, Kent, England.

A Step Down

I think Ed is wrong again. Judging from the situation as it occurred and granting that Al has made the right choice this time, it ought to be quite possible between Al and the new foreman to show Jimmy Brown the error of his ways in a quiet get-together.

If Jimmy can be made to feel that he is respected and appreciated as a good workman, he will probably be content. Having him contented and functioning again as a good workman, which Al admitted he was before talking him into a job he did not want and perhaps felt by intuition that he was not fitted for, will leave a much better feeling throughout the plant.

In this case it would seem to be much fairer and more profitable to all concerned to cure the sore head rather than to let him go, as Ed suggests.

—Jos. A. Falk.

A Step Down

Although I am in favor of giving the shop man the chance he deserves, I cannot but feel that in most cases it is wrong to thrust one of the workmen into taking charge. There is a certain psychological peculiarity connected with the appointment of a home man for foremanship duties. He usually has cultivated a certain amount of familiarity with his fellow workers which, when cut off and substituted with pseudo dignity, cannot but have an unfavorable reaction. If he continues to be on intimate terms with the men, it is at the expense of efficiency.

—John Homewood.

Good Samaritan

The helping hand is not necessarily that of the man who is only philanthropic. The right kind of help to the right kind of man is undoubtedly a good-neighborly deed. Sometimes, however, it is excellent business for the helper. From reasons of prudence it may be much the best policy to help the right man to his feet again. Only thus can present indebtedness become a reasonable risk with reasonable chances of honorable discharge in the near future. Such help may and has put an unfortunate but otherwise sound concern on its feet again, when excellent trading possibilities have become realities. Without question, the helping hand predisposes the beneficiary in favor of the benefactor.

There is a view commonly held that in industrial life the law of the jungle is predominant. This view takes cognizance of only part of the facts, and not the most important facts either. Other laws operate also, and human conditions make business life and activities ever more tolerable, even in the best sense gratifying. Industry, if it still falls far short of the golden-rule principle, in general observes the rule of fair play to the benefit of many. This is not only good, but it is good business.

—W. R. Needham,
Stafford, England.

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TRADE PUBLICATIONS

BEARING MOUNTINGS. The bearing appliance division of R-S Products Corp., 4530 Germantown Ave., Philadelphia, has issued bulletin B-50 describing standard applications for antifriction bearing mountings. The 16-p. booklet is illustrated with drawings and is complete with tables of specifications.

CAPACITORS. How improving power factors with capacitors reduces power costs is explained in a folder issued by General Electric Co., Schenectady, N. Y.

CENTRIFUGAL PUMPS. Leaflet 2224 describes Type SS-B single-stage centrifugal pumps manufactured by Allis-Chalmers Mfg. Co., Milwaukee.

CYCLE CONTROLLER. Bulletin 447 describes Model 6088V process cycle controller which is being manufactured by Bristol Co., Waterbury, Conn.

DIPPING BASKETS. Metal mesh dipping baskets of steel, copper or brass, aluminum, monel and nickel chromium wire for cleaning, pickling and other manufacturing operations, are described in an illustrated folder issued by C. O. Jelliff Mfg. Corp., Southport, Conn.

HAND GRINDERS. Dumore Co., Racine, Wis., has issued the second of its catalog series on hand grinders, including illustrated descriptions of the company's line of mounted wheels, points and abrasive bands.

LEGAL-AID. "Growth of Legal-Aid Work in the United States," by R. H. Smith, Boston, and John S. Bradway, Philadelphia, with an introduction by Owen J. Roberts, justice of the U. S. Supreme Court, has been published by the U. S. Department of Labor. It is a study of our administration of justice primarily as it affects the wage earner and the agencies designated to improve his position before the law. Bulletin 607, its subtitle, is available from Superintendent of Documents, Washington, D. C., price 20 cents.

MANGANESE STEEL. "The Story of Manganese Steel" is the title of a folder issued by American Manganese Steel Co., Chicago Heights, Ill. Its illustrations include drawings and photomicrographs and it gives many applications of this material.

MATERIALS HANDLING. A folder on materials handling with monorail hoists has been issued by the Lo-Hed Hoist division of American Engineering Co., Philadelphia. It includes brief descriptions of the ¼, ½ and 1 ton monorail hoists and hoists, with tables of capacities and ratings.

MILLING MACHINE. The No. 12B high speed vertical miller and profiler, manufactured by Pratt & Whitney division, Niles-Bement-Pond Co., Hartford, Conn., is described in circular No. 424, available from the company. A table of capacity, speeds and weight is included.

MOTORS. "Engineering Pointers" is the title of a folder describing the totally enclosed fan cooled "Linc-Weld" type "E" motors manufactured by Lincoln Electric Co., Cleveland. Ratings are from ½ to 75 h.p.

SPRAY PAINTING. Catalog IB covers the line of industrial spray-finishing equipment and accessories manufactured by DeVilbiss Co., Toledo. It contains new information and tables to aid the finisher in his work. Price changes and descriptions of new items brings this information up to date.

The JACOBS Plain Bearing Improved Chuck

New methods of thread generation in body and jaws give increased grip—greater chucking speed. Practically unbreakable parts assured by new design and modern heat treating. Hardened body and stronger parts result in a chuck with just about double wearing quality. Made correctly balanced, and light for sensitive drilling—medium duty for machine use and portable tools—and in special hollow body models for accurate valve refacing, and for use on the lathe headstock.

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